THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVI. No. 1961.] LONDON, DECEMBER 11, 1900. [52ND YEAR. PRICE 6d.

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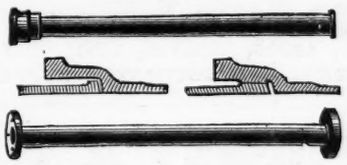

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The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

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THE "MELDRUM" FURNACE
At "The SHEFFIELD TELEGRAPH" Offices.

Reprinted from "The SHEFFIELD TELEGRAPH" June 27, 1900.

A SAVING IN FUEL OF £18 PER WEEK.

A couple of months ago when coal, which formerly cost us 8s. per ton rose to 12s. 6d., we read a lecture on the cost of steam production by John Holliday, in which the following paragraph appeared:—

Mr. Bryan Donkin, M.Inst.C.E., has published figures from some tests he carried out with different kinds of fuel in the same boiler, the conditions in all cases being the same; the results are comparable on the basis of the cost of fuel required to evaporate 1000 gallons.

Kind of Fuel.	Cost of Fuel per Ton.	Water Evaporated per Pound of Fuel.	Cost of Fuel per 1000 Gallons Evaporated.
	s. d.	lbs.	s. d.
A. Dust Coke	5 0	6	3 8
B. ,, Welsh Coal . . .	10 0	8	5 3
C. Large ,, ...	22 0	9	10 11

Discovering that the Sheffield Gas Company made a considerable quantity of coke dust, which they gave away to builders and others, we entered into a contract for a supply for three years. Having a spare boiler, we had Meldrums' forced draught fitted, and soon discovered that coke dust made a very satisfactory fuel for steam raising. Our second boiler was then fitted, and we are now burning coke dust on the two almost exclusively. From an economical point of view, the experiment is very satisfactory, as will be seen from the following figures:—

Average week, Coal only, on One Boiler.

	£ s. d.
45 Tons at 12s. 6d.	28 2 6
Ashes at 2s., Seven Loads	14 0
	£28 16 6

Present Consumption on Two Boilers.

	£ s. d.
Six Tons of Coal at 9s. 3d.	2 15
Coke Dust	3 4 0
Two extra Stokers	2 12 0
Flues cleaning	10 0
Ashes, 12 Loads at 2s.	1 4 0
	£10 5 6

We shall be pleased to show the arrangement to anyone interested in the subject of the economical production of steam. There is no smoke from the chimney stack of the "Telegraph" Office, which is another good point in favour of coke dust as fuel.

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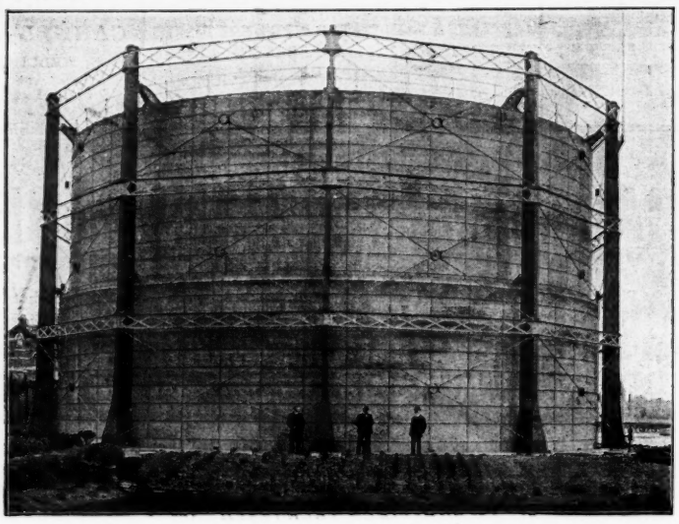

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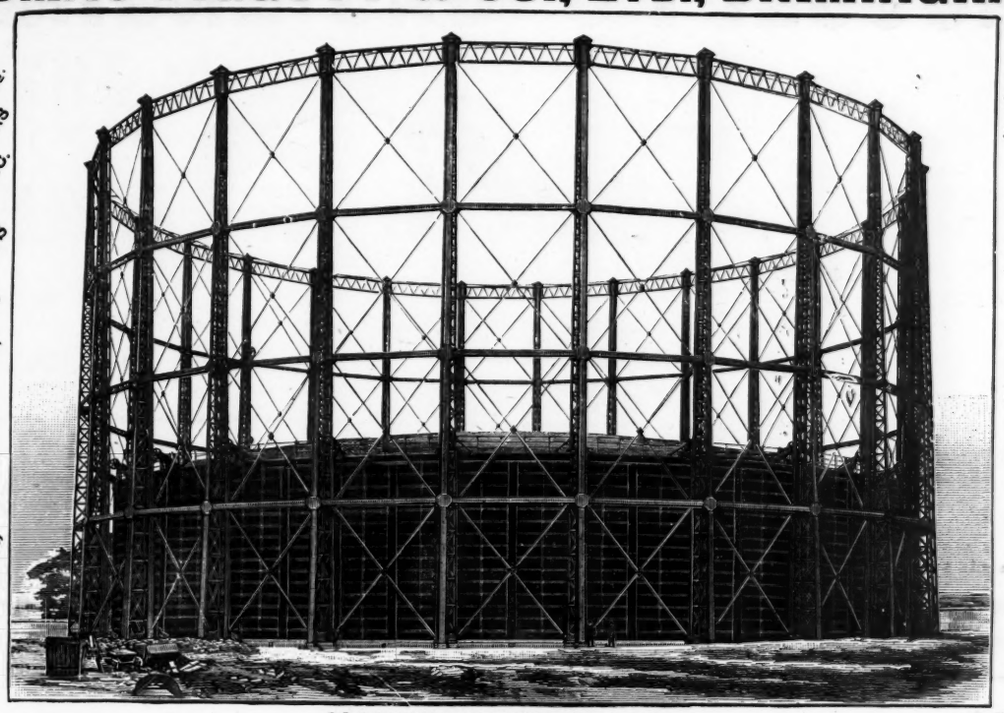

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BATH
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COVENTRY
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SHANGHAI
STOCKPORT
NORWICH
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STOCKTON-ON-TEES
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UTRECHT
DEVENTER
PORTSMOUTH
BOURNEMOUTH
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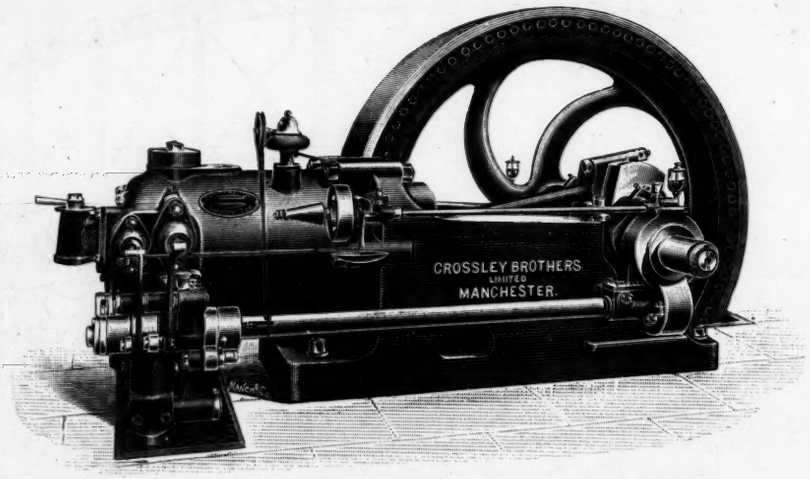

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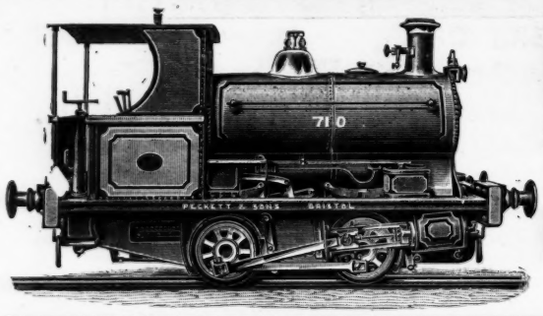

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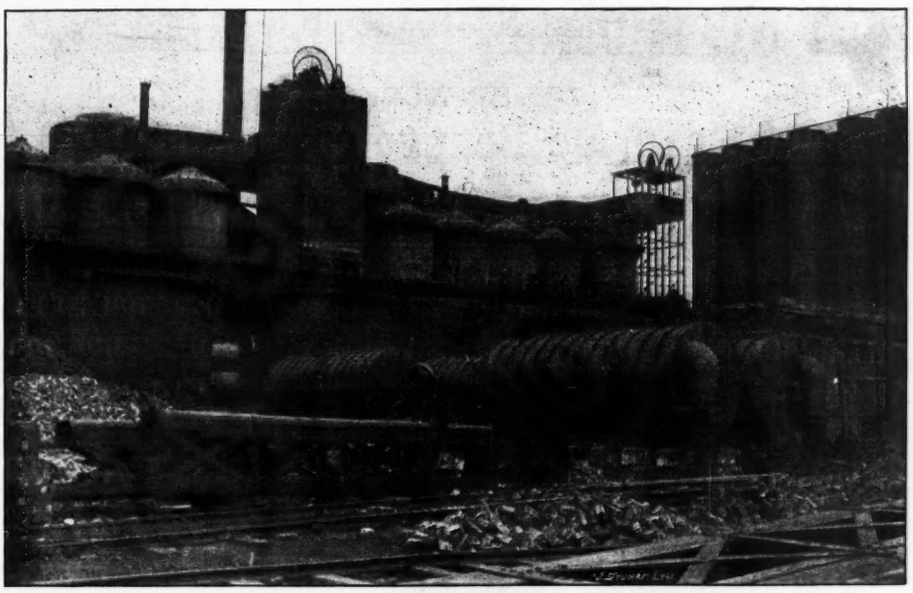

View showing batch of MACHINES for dealing with **5,000,000** Cubic Feet of Gas per diem, for the

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SINCE IMPROVEMENTS PATENTED IN 1895-7,

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	Cubic Feet Per Diem.
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GLASGOW	1,250,000
Do. (Four Machines)	1,250,000
Do. (Four Machines)	2,000,000
Do. (Four Machines)	2,000,000
AMSTERDAM	2,000,000
BRYMBO	1,250,000
MORPETH	120,000
SHILDON	400,000
SUTTON-IN-ASHFIELD	200,000
CHATTERLEY	1,500,000
BROUGHTON-SOLVAY	1,250,000
Do. do.	1,000,000
KELSO	200,000
WISHAW	400,000
WIDNES (Two Machines)	1,000,000
Do. (Machines)	1,250,000
WOODSIDE (Two Machines)	400,000
Do. (Machines)	500,000
TODMORDEN	800,000
ABERDEEN	2,500,000
ECCLESHILL	250,000
LONGTON	1,000,000
PAISLEY (Vertical)	1,500,000
CARLTON IRON CO.	2,000,000
Do. do.	2,500,000
TALK-O-TH'-HILL	2,000,000
CARLTON IRON CO. (3rd Order)	1,250,000
SHETTLESTON	500,000
NANTWICH	250,000
NELSON	1,500,000
ST. ANDREW'S	500,000
SANDIACRE	200,000
JERSEY (Vertical)	500,000
BARRHEAD	500,000
MOTHERWELL	750,000
PADIHAM	500,000
PERTH (Vertical)	1,500,000
SEATON CAREW (Four Machines)	2,000,000
Do. do. (Four Machines)	2,000,000
Do. do. (Four Machines)	2,500,000
Do. do. (Four Machines)	2,500,000
NORTH E. STEEL CO. (Four Machines)	1,000,000
Do. do. (Four Machines)	1,000,000
Do. do. (Four Machines)	1,250,000
Do. do. (Four Machines)	1,250,000
HURST MILLS	500,000
THRISLINGTON	1,000,000
Do.	1,250,000
SHERINGHAM	50,000
BRACKLEY COLLIERY	1,000,000
Do. do.	1,250,000
ORIENTAL GAS CO. (CALCUTTA)	1,250,000
BANGOR	1,000,000
CHATTERLEY (Vertical)	1,000,000
DUDLEY	750,000
Do.	750,000
PLEANE COLLIERY	800,000
AMBLESIDE	120,000
PRESCOT	200,000
LLANDUDNO	500,000
CORK	1,500,000
BIRMINGHAM	2,500,000
FARNWORTH	500,000
FALMOUTH	500,000
BIRMINGHAM (2nd Order)	2,500,000
HARROGATE	1,000,000
HELENSBURGH	500,000
GARFORTH	50,000
MANCHESTER	3,500,000
WEST HARTLEPOOL	2,000,000
PAIGNTON	500,000
POCKLINGTON	50,000
STOURPORT	200,000
TROON	120,000
DUMBARTON (Vertical)	500,000
SALFORD	2,000,000
FALKIRK (Vertical)	1,000,000
STOKE-ON-TRENT	1,000,000
BRACKLEY COLLIERY (2nd Order)	1,000,000
Do. do. do.	1,250,000
CATERHAM	400,000
ILFORD	2,000,000
SEMET SOLVAY CO. (Six Machines)	3,000,000
Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
ROYAL ARSENAL (WOOLWICH)	2,000,000
ELLAND	1,000,000
NORMANTON	400,000
SUNDERLAND	2,000,000
BISHOP AUCKLAND	600,000
TYNEMOUTH	1,500,000
SELKIRK	500,000
BEVERLEY	500,000
HOLMFIRTH	200,000
COATBRIDGE	1,000,000
CARLTON IRON CO. (4th Order)	1,500,000
JOHNSTONE (Vertical)	500,000
ILKESTON	1,000,000
HASTINGS	2,000,000
WALSALL	1,500,000
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LIMERICK	1,000,000
DEPTFORD, S.E.	200,000
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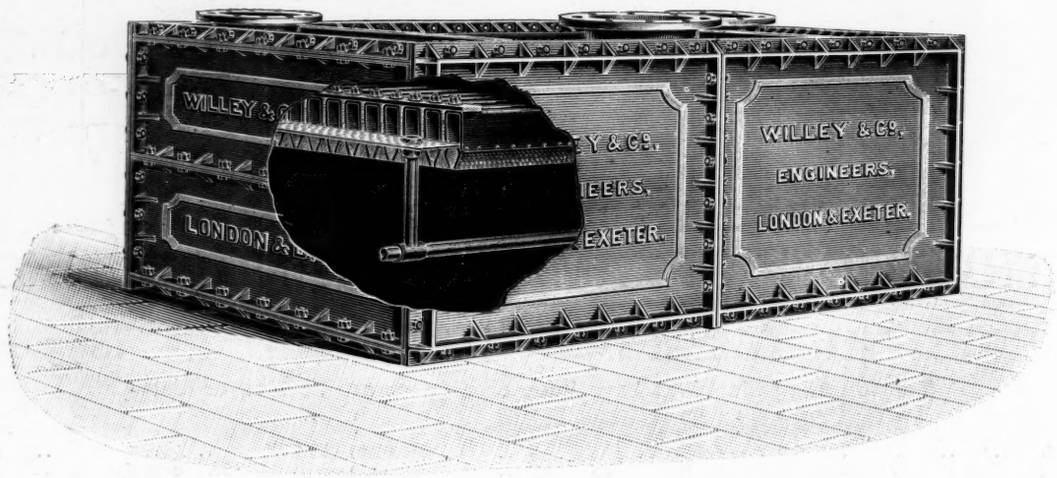

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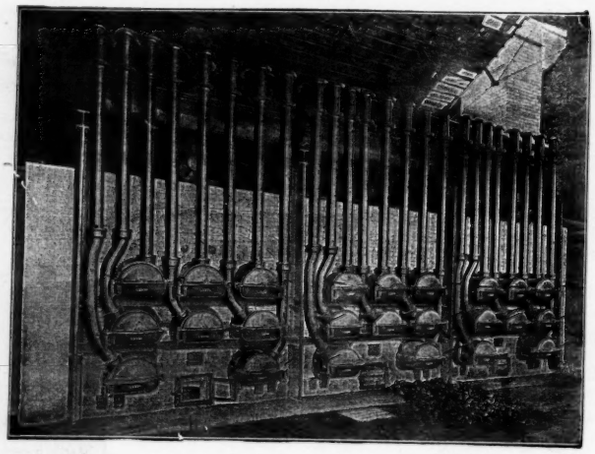

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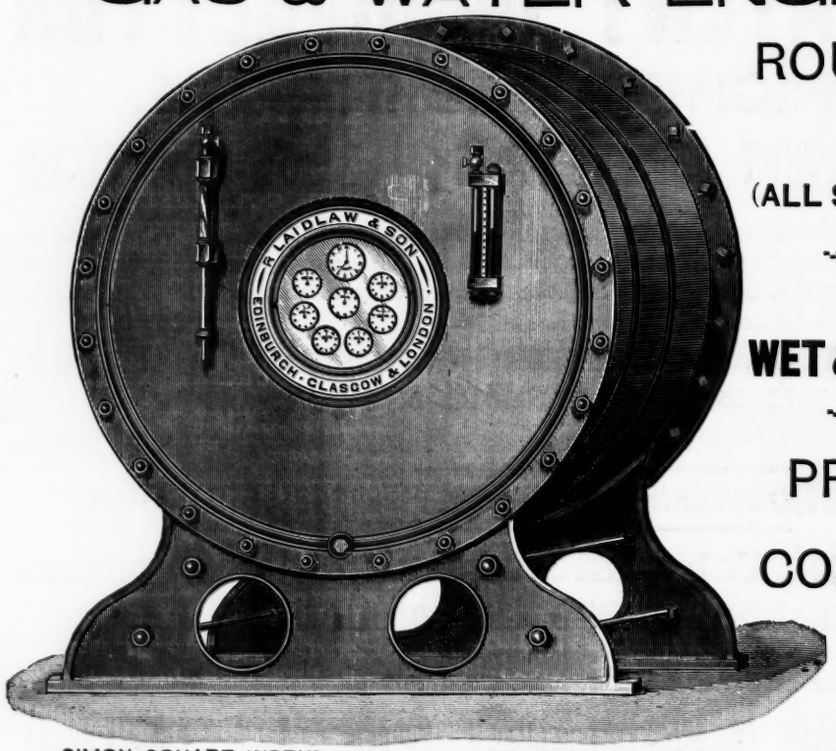

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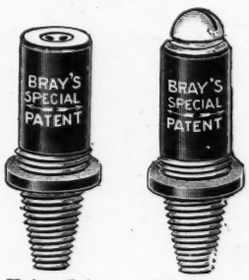

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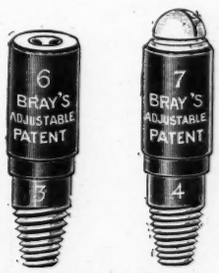

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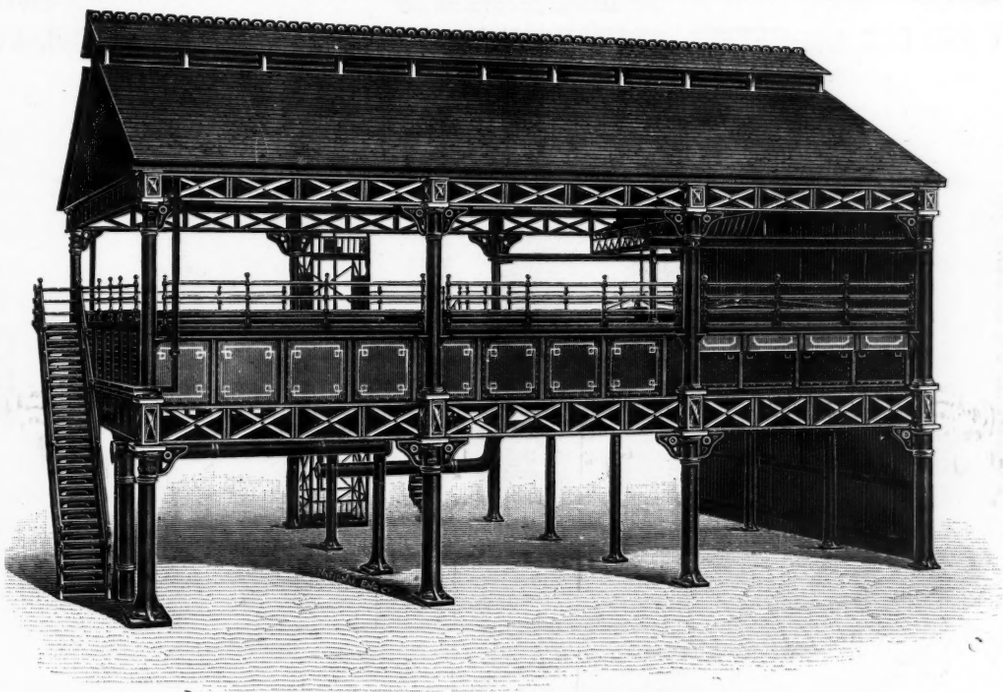

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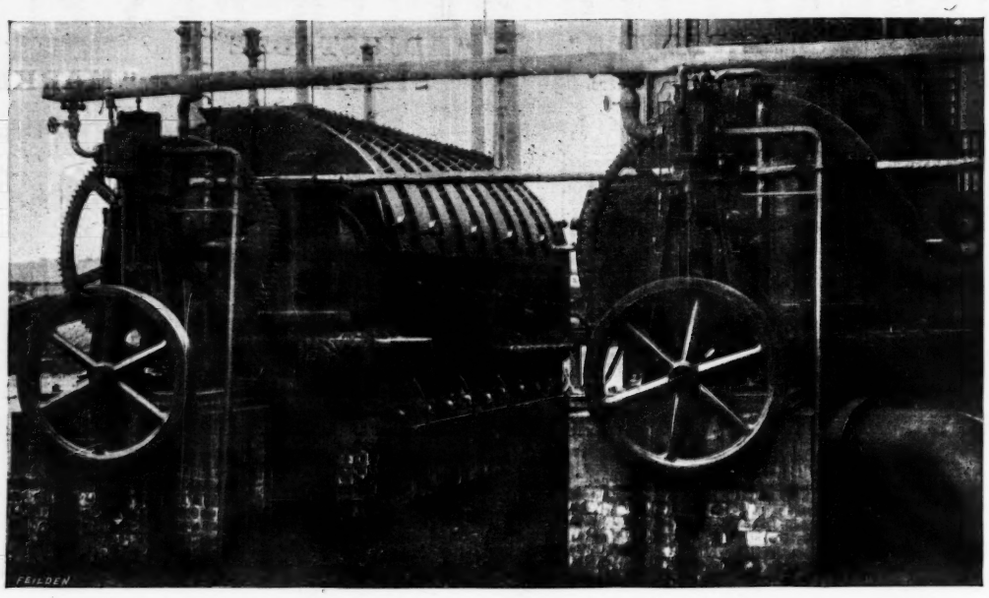

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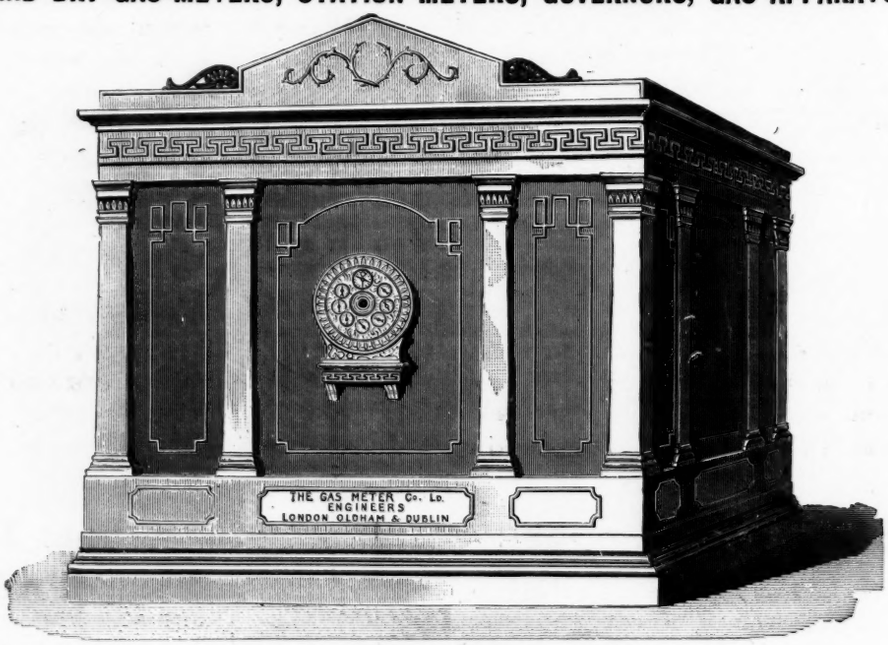

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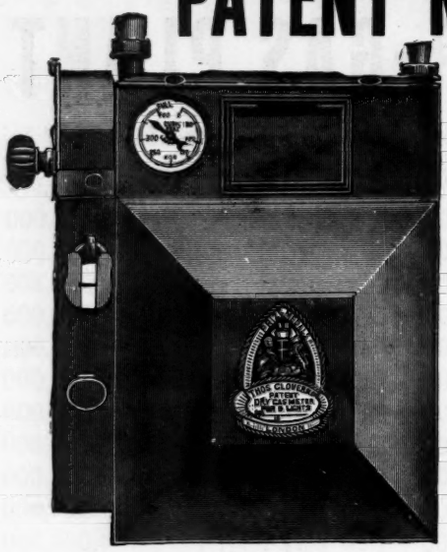

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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Question of Next Year's Coal Supply.

THE progress of events in the coal market during the next month or so will be watched with close attention and thoughtful consideration by all users of coal for industrial purposes—not the least by those interested in the gas industry—and with no little anxiety and apprehension by the coalowners. The situation at the present moment is characterized mainly by a general attitude of waiting; the owners holding out as long as possible against demands for a substantial reduction in prices, and buyers refusing to commit themselves to long purchases at present quotations in the sure and certain hope of better terms in the future. From all quarters of the coal market the report is the same—namely, that though this is the season when many contracts for next year would, in the ordinary course of affairs, be settled, practically no forward sales are being made; while it is significant to note that in the few cases where contracts have been concluded, the prices have not been disclosed to the market. We sincerely hope that all buyers will continue to have the courage of their opinions, and decline to play into the hands of the collieries. "Even "concessions fail to bring out new business," we read. And no wonder, when the extent of those concessions is considered. The railway companies, for instance, who have this year been paying quite 60 per cent. more for their locomotive fuel than in 1899, have been offered the concession of one-sixth of that increase. "Even" that concession, strange to say, has been declined; and it is to be hoped that new business will not be forthcoming from those companies except at a considerably greater reduction in price than the paltry shilling offered them.

The same "childlike and bland" surprise is displayed at the refusal of the gas industry to play the owners' game. "Consumers of gas coals," writes the Middlesbrough correspondent of the "Iron and Coal Trades Review," "are "chary about entering into further contracts, *even though* "these could be placed at 13s. 6d. f.o.b. in some cases, and "14s. would be generally taken." When it is borne in mind that the prices named are fully double normal rates and are only about 2s. 6d. below the top prices being paid on current contracts, our readers will readily understand why the offer is not jumped at by gas managers. In view of the fact that the supply of gas coal is now fully equal to, and in many cases greater than, the demand (the London Gas Companies, at any rate, are being inundated with coal in excess of their contract stipulations), that, even allowing for an increased make of gas next year, the coal requirements of the industry during the ensuing twelve months will not be greater, and may even be less, than during the year now ending, and that trade generally is quieting down, there seems no economic reason why gas coal should not be bought next spring at prices "delivered in London" not higher than those now quoted, and declined, for coal "free on board" in the North. So far as freights are concerned, they are much easier, in spite of the continued special drain on the tonnage market due to the dragging on of military operations in South Africa.

We have said that trade generally is now quieting down. This is, in fact, a somewhat mild expression to use in describing the situation in the foremost industries—the iron and steel making and engineering trades, especially the former. In spite of reductions in the price of iron that leave the makers little or no profit (so long as fuel and labour costs are at their present level), orders grow scarcer instead of more plentiful. Home consumers are everywhere reducing their purchases to the lowest possible point; while the falling off in the foreign sales is plainly shown by the Board of Trade returns for November. The quantity of iron and steel exported last month was only 262,434 tons, against 345,638 tons in November, 1899; and the total shipments for the eleven months of this year show a falling off of 63,322 tons (excluding pig iron, of 171,028 tons), as compared with the same period of last year. This may be said to represent a reduction in the consumption of coal in the manufacture of iron and steel for export of about three-quarters of a million tons, and by the end of the year the reduction will amount to fully the million. So far as direct exports of fuel are concerned, the returns for November show a further increase of 395,290 tons over the corresponding month last year, but a reduction of 105,532 tons as compared with the October shipments. The fall that has so far been witnessed in coal

prices has, therefore, taken place in spite of the foreign demand, which there are reasons to believe will decrease rather than increase next year.

There will, without doubt, be something of a reaction from the tremendous "slump" in the iron and allied trades, in the natural course of things, when the present abnormal and artificial condition of the coal market passes away; and the trade revival in the States consequent upon the re-election of Mr. M'Kinley will have some effect on this side of the Atlantic. But the great rush of trade is over; the "boom" in the iron industry is dead; and the coal consumption by the ironmasters next year will be materially lower than in either 1899 or 1900. The part played by the American makers in bringing about the collapse in iron has been frequently noted in these columns. Some idea of the growth of the exports of iron and steel goods from the States may be gathered from the figures for the first nine months of the present and each of the last three years. The value of these exports, in millions of dollars, during these periods was—1897, 46; 1898, 60; 1899, 77; 1900, 97. Some of this great increase is due to higher prices, but the greater part to increased volume; and the presence of this rapidly growing competitor in the world's market must for a long time to come exercise a very considerable influence in the way of a restraint upon upward movements in iron and steel prices. It is scarcely necessary to add that cheap iron cannot be made with dear coal.

So far, we have only been considering the obvious commercial and economic factors in the situation. No prudent man can, however, afford to leave out of calculations as to the course of any business the human factor; and in no case is it more necessary to consider this side of the question than in that of the coal trade. The coalowners are reported to be possessed of a determination not to allow coal prices to return to anything like the level of (say) three or four years ago. The men are similarly eager that wages should be maintained at present figures. Now, the only way in which the owners and the men can attempt to influence the future of the trade is by a material reduction in the output. But whether the owners can combine effectively for this purpose; whether, if they can, they will elect to pursue such a course, fatal as it must be to the industrial prosperity of the nation; and whether the men will throw away the substance in pursuit of the shadow—remains to be seen. We cannot affect to regard the labour aspect of the question with anything but misgivings, which, it is to be noted, are shared and expressed in their current issues by both the principal organs of the coal trade. It must not, however, be forgotten that the coalowners can grant heavy reductions in prices and still make a profit, with wages at their present level.

Mr. Dibdin on "How Not to Do It."

Mr. W. J. Dibdin and the team of brother-experts which he captained to their discomfiture before Mr. Oldroyd's Committee of last session have been a long time getting another innings. It is perhaps not uncharitable to suppose that they were, up to a recent date, not without hope that the London County Council would oblige with a second opportunity for performing before a Parliamentary Committee. But counsels of prudence have prevailed, for a wonder, at Spring Gardens; and the County Council are content with promoting only one Bill—that for the purchase of the Water Companies—for glory, and without the slightest hope of passing it. In any case, however, Bill or no Bill, Mr. Dibdin and those who agree with his peculiar ideas of the correct way to compare the lighting value of gases of different normal illuminating powers, would still have enjoyed the advantage of airing their views at the rooms of the London Section of the Society of Chemical Industry. We gave the substance of Mr. Dibdin's communication last week, and complete in another column the report of the paper and the discussion. Readers can now form their own judgment of the intrinsic value of it all. Suffice it to say that the principle upon which Mr. Dibdin elected to base his study in comparisons is the same that failed to impress Mr. Oldroyd's Committee. His idea was to start with something which he called "unit light," which seems to be that yielded by a burner when showing a fair and even flame of gas testing 16·2 candles in the statutory manner. This is his datum; and then he tries to produce an equal illuminating power, by the self-same burner, with gases of other qualities, and he books the difference of the rates of gas consumption. Very curious results are produced in this way. Mr. Dibdin's ability as a photometrist is unquestioned. The marvel is that any man professing to be an expert in gas, as well as a photometrist, should pretend that such an arbitrary rule of comparison possesses a shred of practical value. He succeeded in giving a good advertisement of incandescent gas lighting; this system being less susceptible of maltreatment in his chosen manner than that "pale, domestic drudge," the flat-flame burner. But beyond this the paper does not convey any lesson. It is hopelessly vitiated by the false and unnatural method of comparison selected.

The discussion did not produce much fresh information. Mr. Dibdin endeavoured to make some capital out of the circumstance that "all those who were concerned in the "question"—meaning, it may be supposed, the London, and particularly the South Metropolitan Company's Engineers—had declined his invitation to attend and "fairly argue the "question out." But inasmuch as the proceedings were only a hash-up of the business settled by Mr. Oldroyd's Committee, and never revived in the Upper House, it would have been waste of time for Mr. Dibdin's victorious opponents to have talked it over again, to no purpose. Let him freshen up his matter, and above all drop the pretension of impartiality while patently speaking to a brief, and he will be attended to. Mr. Dibdin knows as well as anybody that, if it is to be a point of obtaining the best light-effect from any make or description of illuminating gas, whether by means of a luminous flame or by an incandescent burner, the only sound, logical, and defensible rule is, "one gas, "one burner." No investigation that ignores this rule can be satisfactory, in whatever direction its apparent indications incline. Mr. Dibdin himself gives his fancy method away when he talks, as the words are given in our abstract last week, about "corrections more particularly applied to "burners adapted for very rich gases when employed with "low-grade gases." There is no sense, and certainly no science or fairness, in such misusing of gas and gas-burner. When it is known precisely what kind of gas is to be consumed, there is no difficulty whatever in fitting it with the most suitable burner, of any description. This is the sensible and proper course to take; and this is the course which recommended itself to Parliament last session.

No man is likely to find himself in the position of being supplied with 12-candle gas one minute, and 20-candle gas the next, with one and the same burner to use them with. Yet this wholly irrational position is assumed for, and is indeed the only key to, the mysteries of Mr. Dibdin's misplaced investigation. No competent person pretends even that luminous burners, whether argand or flat-flame, made for 16-candle gas, will answer equally well for either 14 or 18 candle gas by merely turning the cock on or off a little, or altering the pressure. Even an incandescent burner, which is not so delicately organized in this regard as the rough-and-ready flat-flame, will be all the better for adjustment of its air and gas supply to the conditions most favourable for the perfect fulfilment of its function. It is, therefore, no use dealing with the subject of the lighting effect of gases and burners, not only without reference to this fundamental rule, but even while systematically violating it, whether of set purpose or by inadvertence. There does not appear to be very much of the latter quality about this parliamentary evidence of Mr. Dibdin's. He knows quite well what he is doing; and he is not alone in the possession of this knowledge.

Mr. H. Birchenough on Industrial Problems.

The Rectorial Address of Lord Rosebery to the students of Glasgow University has already received notice in these columns; but we are led to revert to the subject by an article contributed thereon to the current number of the "Nineteenth Century," by Mr. Henry Birchenough, one of the Directors of the Imperial Continental Gas Association. The subject of Lord Rosebery's address, our readers need scarcely be reminded, was, put briefly, the existence of dangers in our path as a commercial nation, and the unpreparedness of the country to meet and overcome these dangers. Lord Rosebery's main point was that we had no reason to fear for the future if we would only realize its necessities, and prepare ourselves for conflict with our competitors; that we have the material (that is, the men), but that it needs shaping. We must first find out our best men, train them in the best way, and then use them. Many critics found fault with Lord Rosebery's address because, they said, it contained no practical suggestion as

to how the desired ends were to be achieved. These criticisms appeared to be wide of the mark. Lord Rosebery did not make the mistake of imagining that he could prescribe, in the course of a Rectorial Address, a specific for the restoration to rude health of British Commerce when it shall be sick, or a prophylactic to save it from attack. His aim was rather to arouse public attention to the fact that we, as a commercial nation, are now drifting towards danger, and to induce the wise and experienced among us to face the danger, "and by opposing end it."

For Lord Rosebery knows his countrymen too well to think that they need more than to have the difficulties forcibly pointed out to them. He would undoubtedly agree with Mr. Birchenough that business men in this country rightly "have a dogged, unexpressed belief that "the race which built up the great fabric of British trade " . . . is capable of maintaining and extending it. " . . . They are convinced that the past had its "problems as well as the present, and that so far each "generation has met and overcome its difficulties with the "same quiet courage." Lord Rosebery's purpose was to point out the problem, and leave the business men to say how best it may be solved; and any words of his have, as Mr. Birchenough says, this peculiar value—that the country listens to them. The fact that his address has been so very promptly discussed in the leading Review, is evidence of that fact. What, then, is the "Nineteenth "Century's" contribution to the discussion?

In considering the dangers that lie in the path of British trade, Mr. Birchenough points out, with perfect truth, that those dangers, though they be apparently from without, are really from within. That is to say, it is in commerce, as in war, the case that our difficulties mainly arise from our "want of calculated foresight, of preparation in advance "against all possible contingencies;" and from our "san-"guine conviction that it is no use looking too far ahead, "that it will be time enough to deal with difficulties when "they arise." Most serious of all, he adds, "you have in "both the same absence of—may we not say prejudice "against?—systematic professional training." Here Mr. Birchenough puts his finger on one of the two most difficult problems involved in the general question—one to which we have before called attention. How, he asks, are we to breathe into our people "the spirit which has made "the North Germans the best-educated people in Europe, "with the result that they are turning their country into "one of the most prosperous workshops in the world?"

Technical education as we have it in this country is, it is truly said, "an absolutely artificial growth. Apart from "the great towns, such as Leeds or Manchester, or cer-"tain admirable institutions in London, it has no real "root. It is offered without conviction by those who have "to administer the funds accidentally set aside by Parlia-"ment for the purpose; and it is received with a sort of "sullen acquiescence by those for whom it is intended." There it is—the difficulty that would seem to defy theoretical solution; the absolute antipathy of the average Englishman to education. How many of us, after leaving school and entering business in a subordinate capacity, deliberately undertake the task of fitting ourselves for the most responsible positions in that business? Another question is: How many are encouraged so to do? We do not think that anything short of the bitter pill of adversity will effectually remedy the complaint—that of indifference to systematic and continuous training.

The other of what we have called the two most difficult of the problems involved in the general question is that of the lack of discipline and knowledge among the working classes. The working man, especially the Trade Unionist, wants to be his own master; to say how, when, and where he shall work, and to run the workshop on his own lines. That is his lack of discipline. He is ignorant of the real effects of his interference with the conduct of the business upon its prosperity, and of the prosperity or otherwise of the business upon his welfare. That is his lack of knowledge of the right sort. In combination, these constitute a formidable obstacle for the community to overcome in the race with its competitors. Mr. Birchenough, who speaks very highly of the discipline and education of the German working classes, as exemplified in the stokers employed in the various works of the Imperial Continental Gas Association, quotes the opinion of a prominent and experienced Banker in Berlin, that this country's danger lies in the ignorance of our people; and it is idle to deny that there is much truth in the opinion. How is this ignorance to be removed? All the School Board education—for the matter of that, all the University education—in the world does not appear to be sufficient to teach men the fact that, for the successful conduct of business, there must be masters as well as men.

The Cause of the Business Man in Government.

THE municipally-minded—or if any closer characterization is desired, the parochially-minded—section of the British public has a hot-fit of financial purism in full blast at the present moment. The movement has broken out all over the kingdom, like a rash going through a National School; and on all sides cries are raised for the disinfection of public bodies, from Her Majesty's Cabinet down to Burial Boards, from the taint of illicit financial relations. Ex-Alderman Higginbottom, of Manchester, must experience a bitter satisfaction in feeling his case become that of a type, rather than that of an individual. For the case in question is that of the Business Man in Public Life. His Grace the Duke of Devonshire made haste, on the opening day of the parliamentary session, to proclaim from his place in the House of Lords the glaring truth that he is of the number. A dead-set has been made against the Colonial Secretary for being another. So tender is the conscience of some people on Mr. Joseph Chamberlain's behalf, that they seem prepared to contend that no Public Man ought to have even any distant relation, or connection by marriage, engaged in trade. This is the "Cæsar's wife" standard carried to the *n*th degree. It seems to commend itself chiefly to gentlemen who, for their part, are in public life as paid delegates of Labour organizations, or who live by cheap newspapers that are ever trembling on the verge of an infringement of the Gambling Acts.

Is not this new craze a little unworthy of the common sense and practical aptitude in political affairs upon which Englishmen have been accustomed to pride themselves? Let us once more remember the wise counsel, and clear our minds of cant. It is the cry of the age that our national and municipal business should be done in a business-like way. We are told every day that this is absolutely necessary, for the sake of the future of the country. How is it to be done, if not by business men? What hypocrisy it is to pretend that, while a Minister of State or a Lord Mayor ought to be a man of business, he is ineligible for his office if he holds a share in a steamship company which carries Her Majesty's mails, or is the head of a stationery business which sells ink to the Town Clerk. The supreme folly of this canting cry is proved by the history of any established case of undue influence, bribery, or corruption. Those who want to swindle the public can do it easily enough, where the opportunity exists, without advertising themselves as owning shares in, or as being on the Board of, a company. Indeed, the very publicity of such a connection is its redeeming quality. And we venture to say that the law on the subject is consistent with common sense. No man is rendered ineligible for membership of a public body by reason of his owning shares in a joint-stock company doing business with such authority; but he is not to vote on any resolution relating to a contract between the company and the public body. The case of shareholders, of course, includes that of directors, with the difference—entirely a moral one—due to enhanced interest attaching to administering responsibility.

What is desirable in this regard is that every public man should be a competent guardian of his own honour. In so far as the present clamour may help to set up, and firmly establish, a sufficiently high standard of personal integrity for public men, high or low, it will be of general service. Only, let there be no cant about the matter. Do not let us have one law for the shareholder, and another for the Trade Union wire-puller. It would be a poor bargain to drive all the business men out of public life, and fill their places with penniless professional politicians. The man with an itching palm will be the first to impute motives to persons of substance. The large share that trading enterprises now take in all municipal activities renders it very difficult to properly man the corporations and their executive committees; care must be exercised lest it becomes impossible. Similarly, in national affairs, if we are to get rid of the feudal tradition of government by "the ruling "caste," with the familiar result of Lord Tomnoddy at the head, and Taper and Tadpole at the bottom of the Departments of State, it will be necessary to accept for high office the Business Man as he is, and refrain from slandering him

because his second cousin happens, perhaps, to keep shop in a garrison town.

To bring the general question down to the particular application of the financial or trading interests of persons placed in fiduciary positions in gas undertakings, it must be admitted that a keener appreciation of what is befitting might with advantage be cultivated in some quarters. It is not usually a question of law, but of conscience. What is conscience—the judgment that a man pronounces, practically, according to his lights, upon his own actions? That is the common idea of conscience; but it is not the correct one. Conscience, as a wise teacher has well said, is an organ of perception, not a voice. Its true function is to receive the contemporary expression of the eternal verities which are the ultimate sanctions of human conduct, and give them personal interpretation and binding force. This is no more than the ordinary man means when he says that "there are some things that a fellow can't do." His conscience will not allow of his outraging the laws of conduct which he perceives to be operative upon his fellows and his contemporaries. But let us leave the matter here. Particular cases are alone worth discussing in such a connection, if the talk is not to be all in the air; and personalities are impossible for these columns.

American Coke-Oven Practice.

It is to be hoped that engineers engaged in the work of carbonizing coal on a large scale are keeping themselves posted up in regard to the actual practice of carbonizing by all the known methods. Dr. Bunte mentioned the other day the question of coal carbonizing in bulk for the sake of the saving in labour; and undoubtedly this way of working will appear in a fresh light when the photometer is dethroned. There is no little haziness in the minds of the most accomplished carbonizing experts as to which is absolutely the most economical way to treat bituminous coal. There are so many considerations involved. The solution of the problem depends mainly upon the reply to the query: What is to be the chief product sought—gas, coke, or fluid distillates? The elimination of the photometric test of the gas would appear to unite the two principal products of coal carbonization—gas and coke—in a common cause. The calorific power of coke-oven gas should be about the same as that of coal gas retorted in the ordinary way. Curiously enough, an article on the "Connellsville Coke Region" of America, which appeared in the "Engineering Magazine" for October, supports those sceptics who have not been able to see in the new-fashioned coke retort-oven a technical advance, as a coke maker, upon the old-fashioned beehive oven.

Connellsville coke is the mainstay of the successful American iron industry, of which so much is said to the depreciation of the English iron trade. Last year considerably more than 10 million tons of metallurgical coke were shipped from the region, at an average price of 8s. 4d. per ton. The coal used in the manufacture is a wonderfully suitable material in every way, and is mined from a seam from 8 to 9 feet thick. The coke is nearly 90 per cent. carbon; and with the small exception of a battery of 50 retort ovens, it is all made in the beehive type of coke-oven, with hand drawing, "as machinery has failed so far "to perform that operation either as satisfactorily or as "cheaply as the human coke drawer." The coal is fed into the ovens from railway trucks; but the levelling of the charge is done by hand. "In fact, there are very few "mechanical appliances in use about the coke yards. The "oven now being built is generally 12 ft. 3 in. in diameter "by 8 feet in height, inside measurement." It is, in short, the old beehive oven, unaltered, unimproved. This information will be somewhat surprising to those who imagine that an American manufacturing industry must be all carried on by the aid of machinery. It does not speak well for the retort-oven.

Chemistry at Fault.

It would only be in agreement with human nature, if at this moment all the noble British army of warrantable subjects of the analytical chemist's usual and ordinary attentions—the buttermen, the milk dealers, the water companies, and the providers of gas tested under the sulphur clauses—were to be observed shaking hands with themselves, and heard to "chortle in their joy." Because arsenical poisoning on the largest scale has been going on for years, through the national habit of beer-drinking, and not a chemist of them all detected it! It is not for us to discriminate between the relative importance, in regard to the interest of public health, of a gas supply containing a little more or less sulphur in other forms than sulphuretted hydrogen, or appearing to possess rather more or less illuminating power than is prescribed by statute, and beer impregnated with arsenic in the degree revealed by the latest newspaper "sensation." But there it is. An elaborate official organization, costing a lot of money both directly and indirectly, has been employed (with much solace to itself) in watching over the one technicality—as to which nobody ever pretended that any possible *laches* could have the smallest detrimental effect upon the health of the people. Meanwhile, this arsenic volcano has been completely disregarded, until it burst forth into an eruption that not even an official analyst could fail to notice. What a bitter satire this story is when told of a people that pretends to follow the dictates of common sense in all matters of national and local self-government! The last London Gas Referee appointed was an eminent Physiologist. This is not to his discredit, inasmuch as even a Fellow of the Royal Society need not be ashamed of possessing some knowledge likely to prove useful to the community at a pinch. The pity of it is that the "little tin gods" of Whitehall wasted a good physiologist upon the Board of Gas Referees, instead of employing him to supervise constant and thorough Government inquiries into the character of the food and drink of the people. Peripheral neuritis, due to arsenical poisoning, resulting in 250 deaths during the past two years in the Manchester district alone, is one of the most damaging indictments conceivable of the Chemistry that rendered such a state of things possible at one end of the chain of circumstance, and never detected its existence at the other.

The Secret of Bethesda Disclosed.

Writing last week of the strike at Bethesda, we remarked upon the curious dilemma into which the "Daily News" had fallen as the immediate result of the endeavours of its special reporter to collect a "stream of facts" detrimental to the employer's side in the dispute. The tourist from London, although carrying upon his mission the liveliest prejudice in favour of the quarrymen, could make nothing of them. We observed that the rights of the matter were not finding publicity through this channel; but now it is our pleasing duty to notice the fact that the "Daily News" reporter has learnt more of the truths of the affair, and has had the candour to publish his information. On Wednesday last, the quarries were formally thrown open for work; yet nobody came. The misguided men would neither work nor confer with the management on the reasons for their abstention from employment. And what is more, the men who have thus quarrelled with their bread and butter are afraid to meet and talk the matter over among themselves. Not a single meeting of the strikers has been held; and the "Daily News" Commissioner tells the reason why. It is because the whole thing is "being engineered by "three men, not one of whom has had any connection or "relation with the Penrhyn Estate for years." These mischief-makers profess undying hatred of the quarry management, which they would do anything to discredit; yet they dare not face a mass meeting of their dupes. If one man among the latter had the manliness to declare that the whole trouble was concocted, and that he meant to stick to his job, the great Bethesda revolt would crumble to nothingness. Knowing this, the three wire-pullers shirk the ordeal of a public meeting.

If this story is the truth, it supplies an additional justification for the decision of the quarry management to have no dealings with outsiders. The tale suggests to the Editor of the "Daily News" the sapient reflection that the Conciliation Act was meant to deal with such cases. Most people would incline to the opinion that, if the report is to be trusted, the case is rather one for the policeman. It is impossible to entertain any respect for the men who submit to such tyranny, however much we may pity the lot of those dependent upon them. Is there a Welsh translation of the song about Britons declining to be slaves? Meanwhile, it seems a pity that the arm of the law is not long enough to reach the alleged conspirators against the peace of the Bethesda community.

The Directors of the Commercial Gas Company recently invited Mr. George Livesey to fill the vacancy on the Board caused by the death of Mr. John Blacket Gill; and we understand that he has consented to do so.

WATER AND SANITARY AFFAIRS.

At their meeting last Tuesday, the London County Council adopted the suggestion contained in the report of the Water Committee given in the "Journal" last week, and decided to send the members of the Water and Parliamentary Committees as a deputation to the President of the Local Government Board on the subject of the water supply of the County of London. Information on several subjects is desired by the Council; but their primary object is to endeavour to ascertain what steps, if any, the Government propose to take for giving effect to the recommendations in the report of Lord Llandaff's Commission. While they are at Whitehall, they think they may as well urge upon the President the desirability of making a daily instead of, as at present, a monthly examination of the water supplied to London, and of reconsidering the Board's determination not to furnish the Council with copies of Orders sanctioning schemes of intercommunication between the Water Companies' systems, and the raising of the necessary capital to carry them out. It is useless to speculate as to the kind of reception the deputation are likely to meet with. Since they last went to the Local Government Board, there has been a change of Presidents—not because Mr. Henry Chaplin had not "done the State some service" during his tenure of office, but because the Prime Minister considered his retirement from the Government would be essential in order that vacancies might be created for others. As Mr. Chaplin has publicly acknowledged, Lord Salisbury is primarily responsible for the government of the country; and it is for him to judge who are the men best qualified to be at the head of the various Departments. In the selection of Mr. Walter Long for the Local Government Board, he certainly laid himself open to less criticism than he did in some of the other changes with which he surprised the public after the General Election, inasmuch as Mr. Long was for six years its Parliamentary Secretary, and necessarily knows a good deal about its work. What his views upon the Metropolitan Water Question may be, remains to be seen. Possibly they do not quite accord with those of his predecessor, though they may be in harmony with the present opinions of the Government. There seems to be reason for believing that these have undergone some change; and this may have made it "essential" that Mr. Chaplin should be asked to step aside and make way for one of the "others."

An incident which occurred early last week lends support to the belief just referred to. Speaking at the banquet given by Mr. Dickinson, the Chairman of the London County Council, at the Hotel Cecil, on Monday evening, to the new Metropolitan Mayors, in celebration of the recent change in the local government of London, the Home Secretary (Mr. Ritchie) expressed the opinion that "the "Government ought not unduly to interfere with the legis- "lative projects of the Council;" and the remark was received with cheers. "If," continued Mr. Ritchie, "the "Council desired, as to the water supply and other matters, "only what was right, some measure might be proposed "to Parliament which would be practically unopposed." More cheers followed the utterance of these words. Of course, the speaker may only have been giving his individual views on a subject of general Metropolitan interest. But his statement of them in such unequivocal language on such an occasion, taken in connection with the whole tenour of his speech, points, as the "Builder" puts it, to "a more "sympathetic policy" on the part of the Government with the Council, and especially in regard to the water question. If there was not some kind of authority for the remarks alluded to, they may only have the effect of buoying up the Council with false hopes of support, and of somewhat embarrassing the speaker's colleague at Whitehall when he has to face the deputation. True, Mr. Ritchie safeguarded himself by the use of a little word in which, as we know on good authority, there is "much virtue." The Council must desire only what is right in regard to the water supply, if they wish their proposals to escape opposition. It is precisely on this question of what is right that difference of opinion exists. The Council think it right that they should control the supply, as is shown clearly by the outline of their Purchase Bill which appears in another column. The last Royal Commission thought otherwise; and many agree with them.

As to the other matters which the deputation will bring before the President, they are merely exemplifications of the "fussiness" which is characteristic of the Council. As to making daily examinations of the water, surely, with Professor Thorpe working at the Government Laboratory, Dr. Clowes at the County Council, and Sir William Crookes and Professor Dewar for the Water Companies, the existing arrangements are ample for the protection of the public. London water is good enough for all domestic purposes as now supplied. Let the Council see that it is not contaminated by noxious ingredients, and sent out under another name to poison the consumers. This is where vigilance is required, not in chasing a harmless microbe. With regard to the expenditure on intercommunication schemes, the Board must have been satisfied that it was necessary, or they would not have issued the Orders sanctioning it; and if they have hitherto declined to gratify the inquisitiveness of the Spring Gardens authorities by supplying them with copies, it has doubtless been because they have considered the request for them was not justified. But Mr. Long may have other views on the matter. We shall see.

The winter meeting of the British Association of Water-Works Engineers last Saturday must be described by the oft-used term of "satisfactory" in respect of the fulness of the time occupied by the material submitted for discussion—there was no void space, and no hesitancy in pressing through a substantial programme and in sustaining the discussions. But we have to confess to a dash of disappointment in one regard, and that was in the main feature of the proceedings. After long deliberation, the Water Boards Committee appointed by the members to consider the question of the control of water undertakings and sources of water supply, presented their report. The Committee was a strong one; and we believe—and do so most sincerely—that they have given to the work with which they were entrusted very earnest attention. The men themselves—conscientious to a degree, and known to have the best interests of the water supply of the country at heart—were sufficient guarantee that this would be so. But their report seems to indicate that withal, and notwithstanding their eagerness to reach, and knowledge of the desirability of reaching, the goal for which they set out, other influences have operated to stem their progress. We do not intend here to epitomize their report. It will be published *in extenso* next week, and readers may then peruse it in its complete form with the carefulness which it deserves. It sets forth, under six headings, the principal features of the existing system of water supply which could and should be amended, and which should come under more efficient control in order that justice may be done, and the water supply of the country be preserved from danger and abuse. He would be a bold man who would take up a position of antagonism to the Committee on this part of the report. The obvious and only answer to such a one would be that he was callous to the requirement of the country as a whole for a good, pure, and equitable supply of one of the greatest of vital necessities; and therefore his objection could be accounted of little worth.

There is really nothing in the half-a-dozen sections of the report referred to which was not known before; but the Committee have done excellent service in coalescing, in form both plain and strong, the various arguments in the case for reform. But having presented an unanswerable claim for what they ardently desired when setting out on their work, they stop short; and they could not, it seems to us, more plainly have written in the report, "Thus far "may we go, but no farther." Who stands in the way? We do not know; but we may guess, and will presently make a suggestion. "The remedy," say the Committee after their splendid opening, "is entirely beyond the power "of an Association such as ours, and requires the interven- "tion of Parliament." True; but no one can seriously prevent, though he may strongly object to, the Association suggesting, and assisting in taking steps to secure, the administration of the remedy. "We would, however, "suggest," the Committee continue, "that the members "of the Association should be urged to use their influence "to bring the points in question into prominence with the "view to securing the attention of the various ruling "authorities to them at the earliest possible moment." In this there is a trace of weakness. Why delegate to individual members work which could be better done by bringing the compact strength of the Association to bear upon it? The Association could do as a body a great deal that some individual members would not dare do; and therefore, if the propelling forward of this work is to be left

to individual exertion, it is safe to predict that much of the labour of the Committee, devoted as it has been, will be lost. Then the report winds up with the suggestion that the Association should endeavour to organize the systematic collection of data relating to the following subjects: (1) The available water supply obtainable from various sources; (2) general information in regard to existing water-works; (3) information concerning districts not adequately supplied with water. Such information we do not deny would be extremely useful, and may be of immense service later on if more effective action is determined upon. In the meanwhile, the urgency which aforetime was highly hoisted has been dragged down; redress is delayed; and the conditions which require remedying will be strengthened and enlarged.

We see in this report (we hope time may prove we are wrong) a shelving of the general question so far as the Association are concerned. Members of the Committee in their speeches on Saturday hinted that the Association was too young to have any influence in such a big work. But surely the Association is not so juvenile, nor the positions of the bulk of the members of so little consequence, that the solicitation of the views and adhesion to the cause of other learned, professional, and class representative organizations would not have commanded respectful regard; and, united with such societies, a very strong case might have been presented to the ruling authorities. It is not, therefore, in the youth of the Association that we feel satisfied in looking for a reason for the report with a well-developed body lacking a good head; and, casting about outside the Association, one reason occurs to us. But we may be on quite the wrong road. The Committee (who, by the way, were largely assisted by valuable matter furnished by the Secretary, Mr. Percy Griffith, and Mr. C. H. W. Biggs) consisted of six members: Mr. C. H. Priestley (the President), of Cardiff; Mr. H. Ashton Hill, of the South Staffordshire Water-Works Company; Mr. W. Whitaker, the eminent geologist; Mr. W. Matthews, of Southampton; Mr. Frederick Griffith, of Leicester; and Dr. J. C. Thresh, the Medical Officer of Health for Essex. Mr. Ashton Hill dissented from portions of the report; and of the remaining five members, three are Engineers of municipal undertakings. Now, many of the municipalities of the country do not view the question dealt with in the report with the same enlightened minds that their officials do; and the word "control," as well as certain of the other matters mentioned in the report, is as repugnant and irritating to some of them as is a red rag to a bull. They want none of it; but they take good care to keep a watchful eye over the supply when a company are responsible for it. Therefore it is just possible that the municipalities form the reef over which it would be dangerous for many of the members of the Association to sail. We do not know that this is so; but the report itself furnishes justification for making this suggestion in the absence of a well-founded reason for an otherwise well-considered argument ending with no recommendation of an active nature towards striving for an object not long since earnestly desired.

At a recent meeting of the West Riding Section of the Society of Dyers and Colourists, Messrs. A. Dufton and W. M. Gardner read a paper on their arrangement for the production of an artificial light of the same quality as daylight, and illustrated its practical value. The lamp devised for this purpose was shown at the Bradford meeting of the British Association, and was briefly described a short time ago in "Nature."

On the first day of the new century, the Royal Society will commence the colossal undertaking of cataloguing all the scientific literature of the world. The work will be issued in seventeen volumes, each relating to some particular science. The Society have been guaranteed by the Government against loss to the extent of £5000; but it is believed that little, if any, of this sum will be applied for—the subscriptions for the work having been so liberal.

We have received from the Technical Publishing Company, Limited, of Manchester, the "Practical Engineer" Electrical Pocket-Book for 1901. This is the second year of publication, and many useful suggestions called forth by the first issue have been adopted; thereby increasing the bulk of the book by nearly 50 pages, and consequently enhancing its value. The section on "Gearing" has been revised; and many additional tables have been inserted in various parts of the work. The technical matter is followed by a diary on ruled section paper; and the whole forms a convenient pocket-book which will be found useful to all who are in any way connected with electrical undertakings. It may be had without the diary; and in this form it makes a good book of reference.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1468.)

THE general course of business in the Stock Exchange last week was a fair sequel to the line taken by its predecessor, and without any improvement whatever. Things moved quite irregularly and fitfully—the tendency at one period being rather better, and at another rather worse; but at no time with any pronounced feeling. On the whole, the balance at the close was rather on the losing side; and prices left off with more shrinkages than gains. But the difference was nowhere very much. Perhaps the most conspicuous losers were among the gilt-edged division. In the Money Market, there was an abundant supply for short loans. But discount rates were very firm; and with the inevitable demand for the year's end just looming ahead, the chances are that the stringency may be drawn a little tighter. In the Gas Market, business was much about the same as in the preceding week so far as general activity went; there being no real animation on any one day. The tendency, however, was sufficiently marked to show progress in what we believe may fairly be taken as a process of restoration to public favour of sound gas securities. The shock which they received last summer in consequence of the phenomenal rise in the price of coal, and the unavoidably resultant advance in the price of gas, has worked itself out. The next declared dividends will in some cases be lower than the last. But this will be the last rumbling of the storm; and the future will be showing out brighter and clearer. Changes in value during the week were few, but rather substantial, and were all for the better, with one unimportant exception. In Gaslights, business in the ordinary was very moderate; but prices remained steady at the old figures. The secured issues were quiet and very firm. In South Metropolitan, an increase of strength was apparent almost daily; and the quotation advanced three points. Commercials were more than usually active; and their growing advance was marked by a rise in the new stock. There was not much to remark in connection with the Suburban and Provincial Companies, beyond a rise in Tottenham and Edmonton, which has been for a long time figuring at very cheap prices. Business was very limited in the Continental group; and quotations did not move, though Imperial looked like making an advance. None of the rest presented any feature. The Water Companies offered nothing for remark outside their usual routine. Movements were irregular; Kent rising and Southwark falling.

The daily operations were: Business in Gas was quiet on Monday; but prices were good. South Metropolitan rose 1; but Buenos Ayres debenture fell 1. Tuesday was just as quiet; and quotations were unchanged. In Water, Southwark fell 2. Wednesday was similar; and quotations were still unchanged. On Thursday, there was a little more animation. South Metropolitan rose 1. In Water, Southwark fell 3. Friday was rather more brisk; and prices rose. South Metropolitan advanced 1. Commercial new 2½, and Tottenham "B" 3. In Water, Kent rose 3. Saturday was quiet; and quotations closed without any further variation.

ELECTRIC LIGHTING MEMORANDA.

News of the Nernst Lamp—Improved Forms—Difficulties in the Way—"Nature" on the Electrolysis of Gas and Water Mains.

AT last there is news of the Nernst incandescent electric lamp. The current number of the "Electrician" contains a special account of the article as manufactured by the Nernst Electric Light Company—that concern, it will be remembered, which was floated in this country for doing business in all sorts of places except the United Kingdom. People complained then, with reason, that there was no proper publication of the limited and distant scope of the Company's intended operations in their too-universal title. It will therefore be as well if we follow the good example of our electrical contemporary, and state as precisely as may be how the Nernst light interests are constituted. The patent rights in the system for Great Britain, Germany, and the Continent generally, are in the hands of the Allgemeine Elektricitäts Gesellshaft, at whose stall in the Paris Exhibition the light was shown in action. We believe that, as a matter of fact, the light has not been seen out of the hands of its various dry-nurses. The Westinghouse Company possess the patent rights for the United States and Canada; and Messrs. Ganz and Co. own those for Austro-Hungary and Italy. It thus appears that, so far as England is concerned, the supply of Nernst lamps will come from Germany; while those manufactured here must be exported for Colonial use. Actually, however, it seems that Mr. James Swinburne, the Consulting Engineer to the Nernst Company, and his associates on the Company's staff, have been for two years working out the commercial forms of the lamp. Even now, a price cannot be quoted, nor orders booked for shipment.

It is stated that the Nernst Company have had to adopt for the commercial lamp a lower efficiency than was claimed for the laboratory models. The commercial rating is 1·7 watts per candle power, which is supposed to argue also that it has been found advisable to work the filament at a lower temperature than in the experimental lamps. This drop is believed to account for the longer life of the lamps, which are now reported to last 500 to

1000 hours. It is generally known that the lighting element in the Nernst lamp is a rod of a material which does not conduct electricity at low temperatures, but becomes a conductor when heated. Even then, the temperature coefficient for resistance has still a fairly high negative value. It is, therefore, necessary to add a resistance coil with a positive temperature coefficient in series with the luminous rod, "to prevent instability;" and this regulating coil has a resistance equal to 10 per cent. of the resistance of the lamp. The coil is made of fine platinum wire, wound upon biscuit porcelain. The luminous rod is described as of about the thickness of a pin, carried between platinum wires; the junctions of the two substances being covered by a blob of the rod material. This joint gave a good deal of trouble at first—especially the one at the anode, or positive pole in the continuous-current lamp. It was found that considerable local heating took place here, and that the rod wasted away in the neighbourhood. The mischief is reported to be cured by a fresh arrangement of the platinum binding wire.

Of course, the first bother in the way of making the lamp a commercial article is the necessity of heating the rod. This is effected, in the simplest form of lamp, by applying a spirit-lamp flame to the rod, through a hole left for the purpose in the bottom of the protecting globe. The lamp in its glass globe, therefore, looks very much like an old-fashioned gas-burner in a small-holed ground glass or opal globe. Air is necessary for the burning of the lamp; the reason assigned being that a supply of oxygen is requisite to prevent oxidation of the magnesia which is the basis of the substance of the rod, or perhaps rather to effect the re-oxidization of the magnesium which results from the electrolysis. In the self-lighting form of the lamp, a complicated arrangement exists for heating the rod by means of a resistance coil, which is switched off as soon as current passes through the lamp. It is hinted that there is an "initial cost difficulty" in the way of this Nernst lamp business; which may be easily believed. Again, the necessity of providing for renewal of the perishable portion of the lamp means a good deal. Altogether, and although the "Electrician" is able to testify that the appearance of the Nernst lamps used to light the Company's offices "compares not unfavourably" with carbon filament lamps and fittings, it is possible to gather from our contemporary's guarded expressions of approval of the system, the notion that the long-delayed advent of the commercial Nernst lamp will not immediately revolutionize the electric lighting industry.

A noteworthy little article on "Electric Traction Troubles" appeared in a recent number of "Nature." It dealt with the remarkable slavishness with which English engineers concerned with electric tramway and railway work have copied American methods. "The characteristics of American traction are convenience, comfort, speed, low fares, and a liberal scattering of the electric current over the district generally. Chinese like, we have faithfully adopted them all." The consideration of wandering currents might be put aside, the writer remarks, if the interest, of electric traction were alone to be regarded; but it is otherwise. Shareholders in gas and water companies may well indulge a preference that their own property shall not be interfered with by currents escaping from the "twopenny tube" return conductors. Yet if only one-hundredth part of the current employed on this line were to escape into the gas and water mains, it would mean the loss of a ton of iron yearly from the pipes in the vicinity of the line. The moral urged by the writer is that the return-conductor principle should be insisted upon in all the traction conversion schemes that are likely to be so prominent a feature of English electrical engineering enterprise during the early years of the coming century. The return of current, that is to say, by the metals of the tramway or railway should be absolutely forbidden, for the sake of the gas and water mains.

AN AMBITIOUS INVENTOR.

One who evidently means to attain a position whence he may dictate to gas and coke works the manner in which their manufacturing processes must hereafter be conducted, is Dr. Paul Naef, of New York City. Such, at least, is the conclusion one is forced to draw from the specifications of three English patents recently granted to him. They are perhaps scarcely of the class known to patent experts as "omnium" patents; but they are certainly very comprehensive. They are numbered 20,658, 20,659, and 20,660, and dated Oct. 14, 1899, though the prior date of March 14, 1899, is claimed under the International Convention. The first specification appears to be an innocent enough one of a patent for a "Method of, and Apparatus for, Producing Coke, Gas, and Bye-Products," and it embraces 8 claims. The second, however—which treats of a "Method of, and Apparatus for, Producing Gas and Bye-Products"—is more formidable, if only from the multitude of its claims, which number 45. The third specification, headed precisely as the second, concludes with only 20 claims. It may be of service to readers of the "Journal" if we endeavour to indicate in a brief article what Dr. Naef embodies in his claims, amounting to 73 in all.

He has several laudable objects in view, among which may be mentioned the following: The use of larger carbonizing chambers than gas-retorts, an increase in the amount of ammonia obtained from the coal, provision for continuous in place of intermittent gas production, the manufacture of water gas from coal, pre-heating of the fuel used in making water gas, and general increase in the quantity and quality of the gas and bye-products obtained. Truly, a comprehensive programme, which sets one wondering if inventors have hitherto been idle so far as gas manufacture is concerned, since Dr. Naef finds such wide scope therein for his inventive faculties. But we remember our "Register of Patents," which has assumed so great dimensions that we shudder at the mere thought of a search for anticipations of even a few of Dr. Naef's claims. We shall, therefore, speak of what has hitherto been done only from general recollections, which readers will be fully competent to supplement.

It may, however, first be pointed out that Dr. Naef has previously obtained protection for several inventions. Some of these were in connection with the roasting of ores; and gradually he appears to have left the consideration of the metallurgical processes for the more general question of the proper utilization of fuel in furnaces. Thus he was granted three patents dated April 2, 1898, each for a "Process and Apparatus for Making Coke and Saving Bye-Products. And in the same month, one for a "Process and Apparatus for Producing Ammonia, Cyanides, Coke, and Gas." Then, in June the same year, he obtained, in conjunction with R. S. Garton, two patents, each for a "Process and Apparatus for Producing Coke, Gas, and Bye-Products." And even the three specifications which form the subject of this article are being followed in rapid succession by others in the name of this prolific inventor, bearing on kindred topics. Consequently it would seem that Dr. Naef finds coke and gas production a most attractive field for research, and probably hopes that it may shortly prove a remunerative one to him. As we have already indicated, his earlier inventions were in other branches of technology; and in 1883 and 1884, he was collaborating with Professor G. Lunge in investigations "On Chloride of Lime, and the Reactions in Sulphuric Acid Chambers." He clearly has, as his present specifications indicate, a good knowledge of chemistry; and it may be said at once that there is nothing in his 73 claims which can be rejected as absurd merely from theoretical considerations. Were he less prolific of "inventions," and were his claims fewer, it would be necessary to take him quite seriously; whereas actually we stand amused and amazed at the assurance with which he claims protection for nearly every conceivable modification of the common processes of gas and coke manufacture.

The principle underlying the "inventions" which we are now more particularly considering, appears to be the use of pre-heated gas—such as water gas, either alone or in admixture with steam—for the destructive distillation of coal, and when steam is used also for the production of water gas from the coke formed from the coal. Any form of air-heater or stove, as used for heating the air for blast-furnaces, may be employed for heating the water-gas, which is then passed into the coking-chamber, which may take one of several types previously patented by Dr. Naef, or practically may be of any convenient form. The coal in the coking-chamber is carbonized by the stream of heated gas which takes up the volatile constituents liberated from the coal during its carbonization. The depth of coal in the coking chamber is so proportioned to the stream of gas that the effluent gas is at a temperature only slightly above that at which it would deposit its tar. The gas is then passed into washers for the removal of ammonia, and, if required, it is enriched by any ordinary process. The coking-chamber may be of such a type that the coal is charged in at the upper end, and the coke removed at the lower end without interruption of the process; and it may conveniently be an inclined rotating cylinder or cylinders. The coke produced may be partially used in ordinary water-gas generators, from which the gas—which usually contains some undecomposed steam—passes to the heaters, and thence to the coking-chamber. Now the passage of steam over heated coal or coke, as is well known, increases the yield of ammonia therefrom. Dr. Naef claims protection for the production of ammonia by the action of the steam on the red hot coal or coke. After the gas has passed through the washers for the abstraction of ammonia, it may be led back to the heaters and through the coking-chamber to effect the carbonization of more coal; for Dr. Naef does not confine himself to the application of water-gas only for this purpose, but claims the use of any non-nitrogenous gas. The gas heaters may be heated intermittently by means of producer gas, or in any other convenient way. The description of coke produced may be varied by modification of the plant and conditions of operating. For instance, under the pressure of a high column of fuel, hard coke is formed. It is claimed that the temperature in the coking-apparatus is not high enough to decompose ammonia, and that consequently the yield of ammonia is high.

Such, broadly, appear to be the chief aims of Dr. Naef, as indicated by the three specifications now before us. Innumerable modifications of procedure and apparatus are mentioned; but the intention apparently is to introduce, as far as possible, the use of heaters for air, gas, or steam which is afterwards employed for the gasification of coal or coke, and incidentally for the production of ammonia. Where coal is operated upon, coke, of course, may be a chief product, and tar may be recovered. But Dr. Naef proposes under many circumstances to make gas from both the coke and the tar. The tar, if allowed to pass on with the hot gas to the heaters, would, of course, be more or less broken up, and carbon and gaseous bodies formed from it. Unless the temperature of the heaters is lower than we suppose,

a goodly production of naphthalene would ensue, though we do not think Dr. Naef anywhere calls attention to this possibility. There seems no insuperable difficulty in the way of making his methods for the production of water gas, coke, &c., virtually automatic and continuous in operation, as is claimed for them. Also the use of steam at a proper temperature will undoubtedly give a large yield of ammonia; but such use is by no means a novel proposal. There is a greater degree of novelty in a comprehensive scheme for carbonizing coal by means of pre-heated gas; but we imagine the practical difficulties which would crop up as soon as it was tried on a working scale, would be both numerous and formidable. Its economy would depend upon the loss of heat being reduced to a minimum; but the alternate cooling of gas for the abstraction of ammonia and re-heating for carbonizing more coal, seems to be a scheme likely to involve great waste.

In any case, we should have greater confidence in Dr. Naef's plans if there was rather less to be found about them in the Patent Office archives, and more in the Technical Press regarding their practical application. Dr. Naef, however, has furnished us, in the specification of his English Patent No. 20,659 of 1899, with an unsurpassed exercise in modification, permutation, combination, and imagination.

GAS-ENGINES AND ELECTRIC POWER PLANTS.

[First Article.]

During the last half year, "Engineering" has published a long series of articles by Mr. Philip Dawson, dealing with the subject of the use of gas-engines in connection with electric power plants. Those who desire to be in possession of all the detailed information collected by Mr. Dawson, and recorded, with ample illustrations, by our contemporary, must procure the numbers of that journal, dating from Aug. 10 to Nov. 23, containing this original matter. We propose now merely to pass the substance of Mr. Dawson's work in review, in order to acquaint our readers with its general character and scope. It does not touch, except quite incidentally, upon the mechanics of the gas-engine, and has nothing to do with the possibilities of improving and enlarging this class of prime movers. It stops short, also, of the latest development of large gas-engines as direct users of the motive power of blast-furnace gases. It is, in fact, confined to the description, with very little criticism, of actual applications of gas-engine power to the generation of electricity; and as such it is a very valuable record of accomplished facts.

Mr. Dawson begins his survey from the economic datum of the introduction of the Dowson gas-producer, which he esteems as having been the key to the wider development of the gas-engine beyond the era of small things that endured so long as town's gas was the only available gaseous fuel. It is unnecessary to follow the writer through all the historical steps by which he traces the gas-engine down to its latest forms. He is a little uncertain in this part of his performance, because he does not appear to have taken his retrospective glance across, so to speak, a good specimen of the modern gas-engine. That is really the only safe way to write history. The writer must thoroughly appreciate the merits, and not be blind to the demerits, of the surviving type; and then he can perceive how the former have been led up to by successive tentatives, while the latter have remained intractable all through. Mr. Dawson does not succeed in making it clear that the Beau de Rochas cycle of operations in the cylinder of the internal combustion motor has survived, or why. Neither does he lay stress upon the ultimate shape given to the important details. This, however, by the way. He ventures upon the following list of advantages positive and comparative, and disadvantages, of gas-driven electric plants, as contrasted with steam power. The former comprise: No smoke and no chimney, saving of space, saving of labour, and avoidance of risk of boiler explosions. His recognized disadvantages are: Complicated mechanism, expensive maintenance, difficult speed regulation, costliness, vibration, and heating of the engine-room atmosphere.

This list, we venture to remark in turn, is both incomplete and partial. Some of the most powerful recommendations of gas-engines are omitted from it; while some of the alleged disadvantages are misrepresented. Mr. Dawson's mistake here proceeds from his too arbitrary assumption—contradicted by some of his own selected examples—that producer gas is the only fuel of the kind worth considering. He should, in fairness, have drawn another horizontal datum-line at (say) the 50-horse power engine for town use, and admitted that up to this size of power unit—at any rate, where the ordinary lighting gas is not very dear—the gas-engine using town's gas is far preferable to a steam-engine. We do not propose to catalogue its advantages; the enormous trade done in the engines proving the case in the best of all possible ways. Of Mr. Dawson's specified disadvantages, however, we can only admit the force of one—the heating of the atmosphere of the engine-room. This is a drawback in hot weather, especially as the gas-engine is usually fixed as near as possible to its work; and a more general employment of ventilating fans is the only palliative for it.

Producer gas is as important a division of the subject, in Mr. Dawson's scheme of treatment, as the engine itself. Accordingly, he explains the process of gasifying carbonaceous fuel in a regulated blast of air, and states that "Dowson first made a continuous process of it by blowing in steam and air together." This is not historic truth; the credit for the invention being due to several pioneers in this line, who effected nothing of permanent value, because no suitable applications for the semi-water gas thus made existed. It was the gas-engine that made the gas-producer, for power purposes, commercially possible. Dowson made an excellent apparatus for the purpose, the chief drawback of which was the necessity for using anthracite coal—always a dear, and not an everywhere available, form of carbon. Mr. Dawson wastes some space in describing and illustrating various obsolete kinds of gas-producers. Actually, there are only a few surviving types of this apparatus. Most of these are semi-water, gas producers, more or less modified to work with various grades of coal or coke. Thus, on the Continent the necessity of utilizing the very dirtiest and poorest class of "slack" has led to the evolution of the Buire-Lencauchez pattern of gas-producer, with forced draught. The Gasmotoren Fabrik Deutz also make a successful producer for using coke. There are, however, several British and foreign makes of the apparatus capable of doing good work.

Mond producer gas is a different article, consequent upon the circumstance that it is made from bituminous slack, which is first carbonized and the resultant coke gasified by the assistance of an ample supply of superheated steam, in the generator. Mond gas is treated for the recovery of ammonia, and has a reputed calorific power of 150 B.T.U. per cubic foot. It is therefore no richer than Dowson semi-water gas, which bears the same rating, though it is not invariably realized. Mr. Dawson insists on the necessity for thoroughly washing, screening, and purifying from sulphuretted hydrogen the semi-water gas intended for use in engines, though this adds at least 1d. per 1000 cubic feet to the prime cost. The first necessity, after this cleansing, for the successful use of such poor gas in an engine is a high compression of the charge; and the second is reliable ignition. Electrical ignition, by a stream of sparks, is preferred; tube ignition being reserved for engines using lighting gas. Roughly speaking, the consumption of semi-water gas for power generation to an equivalent bulk of common coal gas is as 4 to 1; and this ratio exactly coincides with that of the calorific powers of the same fuels.

BOARD OF TRADE ANNUAL REPORT ON STRIKES AND LOCK-OUTS.

A preliminary summary of the statistics of strikes and lock-outs in 1899 was commented upon in the "Journal" for Jan. 30 last; in the fulness of time the Board of Trade report, with detailed tables, have now appeared. We shall here refer chiefly to the particulars not given in the preliminary statement; first, however, mentioning the principal points in the general report.

The most noticeable feature in the statistics for 1899 is the great decrease in the importance of the disputes compared with the two immediately preceding years; the aggregate number of days lost through disagreements between masters and men being only 2,516,416 last year, compared with 15,289,478 in 1898, and 10,345,523 in 1897, although the number of the disputes was 719, 711 and 864 in those three years respectively. That is to say, although there were more disputes last year than in the previous twelve months, they involved fewer men, and lasted on the average a much shorter time. Both 1898 and 1897 were, of course, exceptional years as regards the magnitude and duration of trade disputes, owing to the troubles in the mining and engineering trades; but if the figures for 1899 be compared with the average of the preceding five years, a falling off is still shown to the extent of over 70 per cent. In fact, 1899 is the best year on record, and bids fair to so remain; as, although the current twelve months have been comparatively free from labour troubles of considerable magnitude, the total number of working days lost through disputes is slightly higher for the ten months ended Oct. 31 this year than for the whole of 1899, and the Bethesda squabble will help to considerably swell the total for 1900.

Moreover, it is impossible to entertain the hope that the next following years will witness the same comparative immunity from labour troubles that has been enjoyed by the country during the "sunburst of prosperity" in which the nation as a whole has revelled of late, but which is becoming steadily, if slowly, obscured. Prices and wages are bound to fall; and employment is certain to become less constant and plentiful. Then will the voice of the agitator be heard in the land; and he will receive more heed than is awarded him by men when they are in full work at high wages. The practical cessation of industrial strife during the past two years has been hailed in many quarters as of good omen for the future. Gladly would we believe it; gladly would we welcome the growth of a more reasonable and informed spirit in the ranks of the army of labour. But there seems no evidence to justify such a view. It is possible we are tinged too much with incredulity or cynicism or pessimism—time and the event must show. Be that as it may, we can see in the peace of the past nothing but a suspension of hostilities due to the exceptional circumstances of the time, and no acceptable guarantee against a renewal of trouble in the future.

For that view there is no little justification in the detailed statement of the causes or objects of the various disputes that

did take place in 1899. Out of the 138,058 workpeople directly affected by these disputes, 94,651 ceased work on account of questions concerning their wages, 3857 over questions concerning hours, and 8338 for sundry causes; while no less than 31,212, or 23 per cent. of the total, were engaged in disputes over "working arrangements," "the employment of particular classes or persons," and "Trade Unionism." The first of these three subjects of dispute explains itself—comprising all cases in which the men desired to dictate to their employers as to the management of their works, and including some of the demarcation disputes. The balance of those precious disagreements falls under the second heading, which also includes cases of "skilled" men refusing to have labourers as mates. As to the third class, it is stated that "the majority of disputes under this head were due to the refusals of members of Trade Unions to work with non-Union men, and to men being locked out for being members of a Union. Others were to compel payment of arrears to the Union, and otherwise enforce Trade Union rules and discipline. [A sure sign of the coercion employed to induce the men to become members.] Some were against the use of materials prepared by non-Union houses, and others against employers who refused to support joint trade alliances. It will, of course," adds the compiler of the report, "be understood that Trade Unions were in some way connected with a much larger number of disputes than those assigned to this heading in the table of causes." These numbers are most instructive—especially bearing in mind that they show a considerable increase over those for 1898; but still more so is a consideration of the causes assigned to the individual disputes. The following are a few specimens of the numerous trivial and unreasonable causes that gave rise to disputes in 1899. The first deserves "honourable mention."

Bricklayers demanded apology from employer, in consequence of charge of dilatoriness made against one of their number.

There is a quaint humour about bricklayers striking to avenge the insult of such a charge against one of the fraternity, that must appeal to all who have been privileged to watch the bricklayer lay bricks. The only conceivable parallel would be a libel action by the tortoise against Æsop, for suggesting that his movements were the reverse of rapid. We continue the list of the causes inducing men to strike:—

Because a Leigh employer, having work at Tyldesley, employed Tyldesley men instead of paying walking time to Leigh men.

To obtain payment of London rates by a London contractor employed on a job at Lowestoft.

For reinstatement of colleagues suspended for misconduct and breach of discipline.

Employment of non-Unionists in place of Unionists who had absented themselves without leave.

Against discharge of a foreman, and objection to the successor appointed.

On introduction of machinery to do part of certain work previously done by hand; the men demanding an advance in the piece rate for the remainder.

For promotion of one of their number according to seniority.

Because one of their number had not been promoted. [In one of several such cases, 60 surface workers at a colliery struck work because their employers did not see fit to promote a haulier. Some 1520 colliers were thereby thrown idle.]

Against proposed reduction in number of men to a given number of machines.

Because employers gave inside work to a non-Union man who had previously been working outside.

Objection to minding three machines instead of two.

These are only a few of the many cases detailed in the appendices to the report, which go to prove that the reduction in the aggregate disputes was due, not to the increased reasonableness of the men, but simply to the soothing effect of abnormally high wages, and to the fact that, business being so extraordinarily flourishing, masters preferred giving way in many cases to unfair demands rather than risking the loss of their share of the good things going—demands that at another time they would have rather closed their works than yield. In the engineering trades, the struggle of three years ago has evidently not taught all the men reason; 11,247 days' work (and wages) being thrown away last year over the subtleties of "demarcation." The prolonged dispute in the plastering and general building trade, caused by the unsuccessful attempt of the men to force the foremen to join their Union, was also not calculated to strengthen one's faith in the common-sense of the working man. The employers were decisively victorious—taking advantage of the occasion to insist upon the removal of some irksome restrictions upon their management procedure—while the 4000 men involved lost some £15,000 of wages.

In the settlement of the disputes of last year, arbitration, conciliation, and mediation had but little share; the disagreements so settled affecting only 11,705 workpeople out of a total of 180,217—by far the larger proportion of the 11,705 being involved in the building trade disputes. The plasterers' lock-out was, it will be remembered, helped to a conclusion by the good offices of the Editor of the "Daily News." As to the other 168,512 persons concerned in, or affected by, strikes or lock-outs, 7054 returned to work on the employers' terms without negotiations taking place, 3980 were replaced by other hands, 95 were the cause of the works at which they were employed being closed, while the great bulk (about 157,000) came to terms with their employers by means of direct negotiation. It will, therefore, be seen that, while Conciliation Boards have done much good work in the direction of settling vexed wages questions, and thereby frequently have prevented stoppages of work—it may be remembered that, of the total number of workpeople obtaining increased wages last year, 32 per cent. received higher rates of pay through the medium of Conciliation Boards and such-like bodies—yet, when once a dispute has reached the point of a cessation of work, conciliators and arbitrators are rarely able to achieve much good. The Conciliation Act was responsible for the settlement of but two disputes—the one concerning 1200 bricklayers at Leicester, the other 464 jute weavers at Aberdeen. Generally speaking, individual arbitrators or mediators of local standing—such as the Mayor or Provost of the town—appear to be most successful in bringing about the termination of quarrels between employers and employed.

So far as the result of the various disputes is concerned, it may be noted that those involving 44 per cent. of the total workpeople affected ended entirely in favour of the employers, those involving 27 per cent. in favour of the employed, while the remainder were compromised. The employers were most successful in the case of disputes classified under the heading "Trade Unionism;" being completely victorious as regards 75 per cent. of those particularly vexatious troubles, as compared with the 3 per cent. in which the men won outright. It can only be hoped that this result will continue to be witnessed in the future.

These are the most interesting features concerning the labour troubles of 1899, as recorded in the Board of Trade Annual Report. In some three weeks' time, the overworked officials of the Labour Department will, we presume, begin the task of compiling the report for 1900, which it should not be impossible for ordinary mortals to produce by the end of January. But then, of course, Civil Servants are not ordinary mortals. They are firm believers in the maxim "*Festina lente*."

PERSONAL.

Mr. RANKIN, Manager of the Clonmel Water-Works, has been appointed to a similar position at Lymington, in succession to Mr. A. Hughes.

It is announced that Mr. F. P. DAVIS, who for a number of years has been Secretary of the Dawlish Gas Company, will resign the office at Christmas.

Mr. W. JOHNSTONE, who has been for seven years Manager of the Dalbeattie Gas Company, has been appointed Manager of the gas undertaking of the Millport Corporation.

At the first ballot for the present session of the Institution of Civil Engineers, Mr. WILLIAM DOIG GIBB, Engineer of the Newcastle-on-Tyne and Gateshead Gas Company, was elected a member.

Mr. GEORGE HEMINGWAY, Gas Manager to the Driffield Urban District Council, has been appointed Manager of the Chester-le-Street Gas Company's works, in succession to Mr. W. FORSYTH, who has resigned after 27 years' service.

Mr. LAUCHLAN M'INTOSH, who has for the past thirty years been Manager to the Meigle Gas Company, has, on account of advancing years, resigned the appointment, and has been succeeded by Mr. WILLIAM ROLLO, jun. Mr. M'Intosh, although upwards of eighty years of age, enjoys excellent health, and has many friends in and around the district. On the celebration of his golden wedding two years ago, they presented him with a purse of sovereigns.

Coal in Rhodesia.—According to a statement published by Reuter's Agency, the report of the experts sent out by the British South Africa Company to inquire into the reported find of coal in Rhodesia practically confirms the original statements made with regard to it. The coalfield is situated some 180 miles north-west of Bulawayo, and is known to extend over at least 400 square miles. The seams vary from 5 to 16 feet in width; and as the coal lies within 40 feet of the surface, it will be worked by means of inclines instead of shafts. It is estimated that at least 1500 million tons will be available, after making an allowance of 20 per cent. for loss. In so large an area the quality naturally varies; but the experts declare that the coal is better than that now in use in the Transvaal, Natal, and Cape Colony, and, in some cases, compares favourably with the best Welsh coal. In view of the confirmation of the value of the discovery, it has been decided to take the Cape to Cairo Railroad through the centre of the coalfields and on to the Victoria Falls.

Price of Incandescent Gas-Burners and Mantles in Spain.—According to the "Revista Minera," incandescent burners and mantles are more expensive in Spain than anywhere else. The Welsbach burners cost from 8 to 10 pesetas (1 peseta = 9½d.) in Madrid; whereas in Germany the Voelker burners only cost 2·5 pesetas. The reason for this is, according to our contemporary, the ignorance and indifference of Spanish consumers and manufacturers. The Kern burner also will be sold in Spain for probably twice or three times as much as anywhere else. It is the same in the case of mantles. When bought of the gas suppliers, they cost 1·75 to 2 pesetas each, and last 800 hours. In Germany, the Voelker mantles are sold for less than 80 c. They, however, are not the most remarkable for cheapness, as German mantles are sold in London at less than 47 c. apiece, after paying carriage and cost. The question therefore arises: Why cannot these mantles be sold in Spain approximately at the same price as in Germany? The present position of affairs is prejudicial alike to suppliers and consumers of gas.

NOTES.

Estimation of Nitric Acid in Gas Analysis.

It has been observed that when a mixture of nitric oxide and hydrogen in excess is passed through a capillary glass tube containing platinized asbestos, both nitrogen and ammonia are simultaneously collected, though in variable proportions, besides a certain amount of aqueous vapour. Herren G. von Knorre and K. Arndt have recently been making experiments on this matter, the results of which have been given in the "Berichte," and summarized in the "Chemical News." The authors carried them out in a platinum capillary tube heated to bright redness. Under these conditions, if the current is very slow, no ammonia is formed, and the reaction takes place according to the equation

$$2NO + 2H_2 = N_2 + 2H_2O,$$

with the contraction of 1·5 times the volume of NO. In the same manner, nitrous oxide reacts under similar conditions with an equal contraction of its volume—

$$N_2O + H_2 = N_2 + H_2O.$$

By this means we are enabled to make analyses of the following mixtures: NO with N_2O, NO with N, N_2O with N, N_2O with O, and so on.

The Value of Reflection in Lighting.

In the "Student's Column" of the "Builder" for the 10th ult., there is given a calculation of the enhancement of an artificial lighting effect due to reflecting surfaces. The writer explains that the amount of the illumination produced in a room depends greatly on the reflecting powers of the walls of the room. It can be proved that if r be the average reflecting power of the surfaces of a room, then the illumination produced varies as $\frac{1}{1-r}$. For mirrors and clean whitewashed surfaces, r is 0·8; but for brown or chocolate-coloured paper r may be as low as 0·1, and for black cloth it may be only 0·01, or even less. To get approximately the average reflecting power of the walls of a room is not difficult. Suppose, for example, that the reflecting power of the ceiling is 0·8, that of the walls (yellow) 0·4, and of the floor 0·2—then, if the area of the ceiling is equal to the area of the floor, and if the area of the walls is four times the area of the ceiling, we have

$$r = \frac{0{\cdot}8 + 4 \times 0{\cdot}4 + 0{\cdot}2}{6} = 0{\cdot}43.$$

Hence the initial illumination of such a room may be said to be increased $\frac{1}{1-0{\cdot}43} = 1{\cdot}75$ times, by the reflecting power of the bounding surfaces. If the whole of the bounding surfaces were covered with the best mirrors ($r = 0{\cdot}9$), then the apparent illumination would be increased ten times. In order to complete this statement, it would be necessary to give an explanation of the term "luminous flux," as applied to designate the total illuminating effect of a light source.

The Amount of Air Necessary for Ventilation.

Mr. R. Gordon Mackay writes to the "Engineer" respecting the capabilities and requirements of mechanical ventilation for crowded public buildings. He points out that the air propeller or fan is many times more efficient as a mover of air than the induction set up by a furnace at the bottom of a tube or flue. He has computed the following figures giving the necessary hourly supplies of air to prevent the vitiation of an enclosed atmosphere beyond 8 parts of carbonic acid in 10,000, which would be classified as excellent ventilation.

	Cubic Feet per Hour.
Strong man at rest	2000
" " work	3200
Average man	1640
" woman	1500
Young man	1500
" woman	1140
Boy	910
Girl	860
One cubic foot of coal gas	1400

With ducts and flues well designed, and not too tortuous, the best machine for securing these results in a public building is an air-propeller or a slow-running centrifugal fan. The air can easily be warmed by passing it over a coke-fire or steam-coils, and damped by a steam spray or filtered. Unfortunately, especially in the case of churches, architects generally ignore the necessity for making structural provision for adequate ventilation. Modern experience shows, morever, in the example of the London Hippodrome, that the occasional removal of the roof bodily is the only perfectly successful way of sweetening the atmosphere of a crowded interior.

Orde on Liquid Fuel Burners.

A very fair review of existing methods of burning oil fuel was lately given by Mr. E. L. Orde, in a paper read before the North-East Coast Institution of Engineers and Shipbuilders. The economic question is not involved here; the treatment of the subject being purely mechanical. Mr. Orde considered liquid fuel burners as divisible into the three classes of mechanical spray, gaseous spray, and vapour burners. His experiments were carried out with crude Borneo oil, which he describes as in all respects an excellent fuel oil. Its percentage composition is: Carbon 87·9, hydrogen 10·78, oxygen 1·24. The flash-point is 2·11° Fahr.; and the calorific value by the bomb calorimeter is 18,831 B.T.U. It is exceedingly clean and mobile. With purely mechanical spray burners, large brick-lined furnaces are needed; and the air required to complete the combustion is very largely in excess of the theoretical quantity. The best evaporative duty recorded for this system is 12·5 lbs. of water from and at 212° Fahr. per pound of oil. The advantages of the system are noiselessness and simplicity. The best steam or air spray processes give a higher evaporative duty. Mr. Orde inclines to the belief that oil-burners of the vaporizing class are the most promising. At the same time, no really satisfactory burner of this kind is yet forthcoming. The chief objection to steam-spray burners is the weight of steam they consume; but this is only of cardinal importance in the case of ocean steamships. The advantage of steam in the spray is that it prevents the cracking-up of the oil, and keeps it as vapour. Air-spray is at several disadvantages as compared with steam. The air compressors take a lot of power; and the difficulty of securing complete combustion and regulating the burners is very great. The impression conveyed by the paper is that the economical and mechanical advantages of oil fuel remain doubtful.

"Practical Gas-Fitting" is the title of a little book just brought out by Messrs. Cassell and Co., Limited, under the editorship of Mr. Paul N. Hasluck, the Editor of "Work" and the "Building World." It is a digest and re-arrangement, in a convenient form, of contributions to the last-named publication, with the addition of chapters on gas manufacture, incandescent gas lighting, and cooking and warming stoves. Out of the 156 pages covered by the contents of the book, only about 40 are devoted to gas-fitting proper—viz., the chapters on laying gas-pipes in the house and gas-fitting in workshops and theatres and for festival illuminations. The text is clearly printed and fully illustrated; and there is an index.

Hillenbrand's Hydraulic Blower.—We have received particulars of this apparatus, which is made by Lux's Industriewerke Actien Gesellschaft, of Ludwigshafen-on-Rhine, Leipsic, and Munich, and is intended to provide a high-pressure supply of air or gas for any of the many purposes for which such a supply is required. Among the uses mentioned in connection with the gas industry are blowing air into purifiers for revivifying oxide *in situ*, providing high-pressure supplies for gas-engines and incandescent lighting, and testing gas-meters. The apparatus is said to be readily fixed in position, to remain at rest when the high-pressure supply is not required and to re-start automatically as soon as the demand comes on, and to maintain a uniform pressure, which may, however, be altered at will. The motive power is ordinary service water, which remains clean, and may be subsequently employed for other purposes. The apparatus is made in several sizes to suit different requirements. For instance, one occupying a space of 22 in. by 51 in., and 5 feet high, will give over 300 cubic feet of air or gas a pressure of as much as 12 inches.

A New Marine Illuminant.—Last Thursday night, a demonstration took place at Westminster Pier of a new illuminant called the "Marine Torch," which is being brought into notice by the Marine Torch Company, of Baltimore, U.S.A. The torch consists of a plain hollow cylinder of metal, sealed at both ends, and containing in a wire basket a quantity of carbide of calcium. From this acetylene is generated through combination with the water, which, on the torch being thrown overboard, enters by several holes at the base of the cylinder. At the head, a number of small burners are arranged; adjacent to them being a chamber containing a few pieces of calcium phosphide. This, through contact with water, creates phosphuretted hydrogen, and ignites the acetylene gas when it issues from the burners, and having an air-chamber at the upper part, maintains, when in the water, an upright position. Within a few seconds of the cylinder being thrown overboard, the flame bursts out from the burners, so rapid is the chemical action set up. The 6-inch torches used at the demonstration were said to give a light of 2000-candle power. They were charged to burn an hour and a half.

Precautions in the Use of Acetylene.—An accident with an acetylene generator for use with a projecting lantern, by which the operator lost his life, has prompted Herr Herzfeld, of Augsburg, to write an explanation to the "Hassfurter Tagblatt," from which we take the following details. The accident was due to the ignition of a mixture of acetylene and air in an apparatus which had just been put to work, and from which the air had not been completely expelled. The door of the generator appears to have been opened, and a lighted match held near. An explosion naturally ensued, by which the operator—Herr Schlenk, of Schweinfurt—was fatally injured. Herr Herzfeld reiterates the necessity for observing the following simple rules in the manipulation of acetylene apparatus, whether large or small: (1) Apply a light at the burner only [the holes in the burner are so small that the explosive wave is arrested even when the service-pipe and holder or generator contain a highly dangerous mixture of acetylene and air]. (2) Search for a leak by applying soapy water, and not with a light. (3) As a precautionary measure, let the mixture of gas and air obtained during the first few minutes after starting the generator pass into the open air unlighted. Herr Herzfeld concludes that, if these reasonable rules are observed, acetylene is no more dangerous than other illuminating gas.

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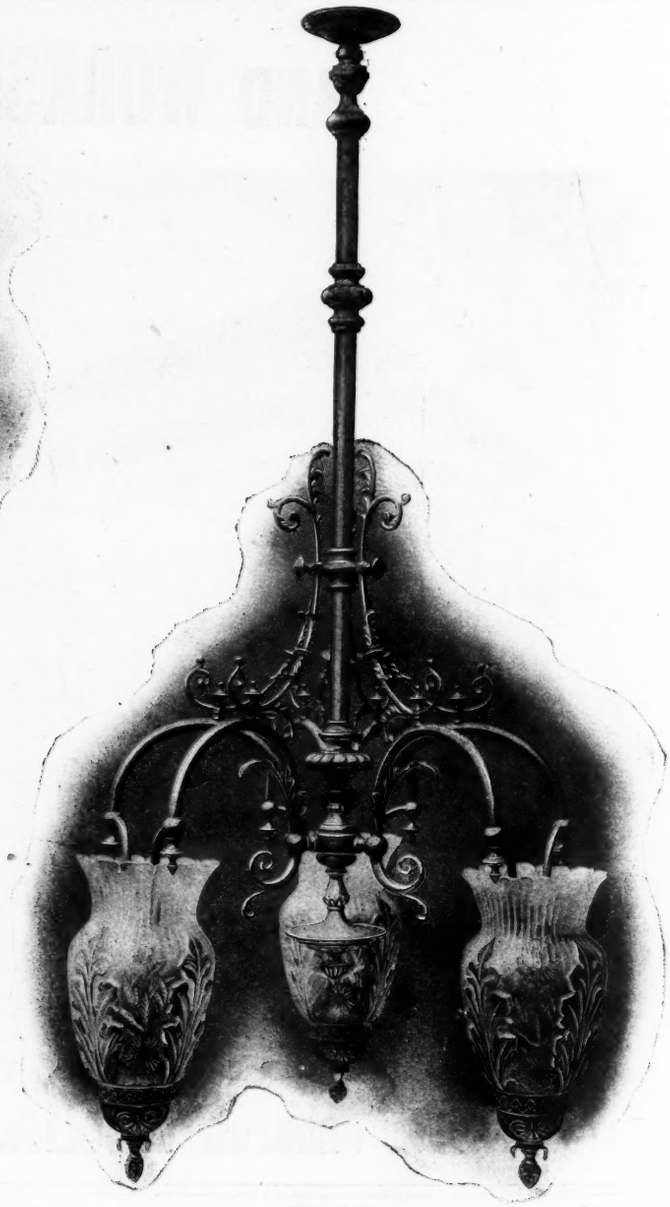

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COMMUNICATED ARTICLE.

THE FUTURE OF THE GAS PROFESSION.

By One of the Past.

The following remarks are the outcome of several years' experience, not only as an engineer and manager of gas-works, but also as a director. They are offered, not with a view of showing up the weak places of the present procedure, but in order to indicate some directions in which to look for improvement. For recent references to this subject, both in the editorial and correspondence columns of the "Journal," seem to indicate that there is something rotten in the State of Denmark, and the existence of considerable dissatisfaction in respect to the gas profession. I take this term to be a general one—covering the engineering or purely structural part, such as designing and superintending the erection of new apparatus; the managing part, such as the control of workmen, and other matters incidental to the daily operations; also buying and selling, negotiating with consumers as individuals or corporations, and other things that pertain to the commercial and financial department.

One complaint is that young men of the first order as regards education and ability are not eager to enter the gas profession. Another is that those who wish to enter have but indifferent opportunities for qualifying themselves; and a third, that those who have qualified are not able to obtain a footing or to satisfy a board of directors on the subject of their ability. These questions, like the poor, are always with us, in a more or less acute degree. They have existed in gas circles for the last forty years at least; and some of the recent utterances are but a re-echo of paragraphs to be found in the early Inaugural Addresses delivered before the British Association of Gas Managers. They are likely, too, to continue, for a time at any rate. The gas profession never was appreciated at its proper value by the best and most prominent engineers and scientists, and by those who are most likely to have a voice in advising young men of the highest order on the choice of a profession. There is no strong central authority to which the beginner can apply for special guidance as to education, or for a certificate of competency when that education is completed; and I fear that the deserving but unsuccessful class will never lack representatives.

The usual understanding in the gas profession, as in most of the similar industries, is that the neophyte should begin at the beginning and take the bottom seat in the class. After having utilized, so far as his ability, his inclination, and his sense of duty permits, the educational facilities that fortune or providence has placed in his way, he is told that he must be content to start at the bottom of the ladder. The best possible education, though essential, is not everything; and a hatful of certificates and medals does not prove that a man is a competent manager or secretary. It only shows that he has acquired the necessary accomplishments or technical knowledge, which is rather another thing. There are physical fitness and many other questions that must be taken into consideration by an employer, in respect to which the certificate is necessarily absolutely silent. Having mastered the technical curriculum, there is commercial and general experience to be obtained, a knowledge of business usages, and other things that cannot be learned outside the gas-works and offices. There is character and judgment to be developed, which can best be done by a course of training in a subordinate position. Some men—the exception and not the rule—have sufficient natural ability to dispense with one or all of these preparatory courses; but this simply means that they have acquired the necessary qualifications by a process of self-education, or that they have sufficient mother-wit to conceal or cover to some extent their deficiencies at the beginning, and trust to experience to make up the rest, like a teacher who keeps just a lesson ahead of his pupils. But characters of this sort are few and far between; and the rank and file require guidance, and cannot get on without it. One frequently hears that a candidate, though technically well qualified, is considered too young to be elected for an important post. The appointing authorities are of opinion that, although satisfactory from an academical point of view, he is wanting in respect to experience of human nature and of ordinary business practice. The sterotyped reply is that the fault is remedying itself every day. But according to the latest ideas, the young man, while unable to claim knowledge of men or of business, or foundation for mature judgment as to the important matters in relation to his subordinates, his superiors, and the customers on the other side of the counter, may pit his youthful freshness of intellectual and physical strength as a set-off against deficiences of this character.

Apart, however, from the question of youth *versus* middle age, which has really acquired prominence more on account of the fact that the youth is willing to work for a lower salary, than of any inherent superiority of quality in his work, is there any demand in the gas profession for education, ability, and enterprise of the best and highest order? Whatever may be the faults peculiar to directors of gas undertakings, it cannot be said that the exercise of favouritism, by the appointment of relatives, personal friends, or useful business connections to lucrative positions on the staff, without regard to capability, is among them. Whenever it is necessary to discharge the invidious and unthankful task of making a selection of the candidate most suitable for an important post, there are sure to be some outsiders, and possibly some insiders also, who, for various reasons, are not prepared to endorse the verdict. It is doubtful, however, if many of them could improve upon it. But the average director is more apt to veer to the other side of the compass, and to regard the presumptive manager or secretary as a well-developed salary-in-the-slot machine, rather than a fellow creature. He looks upon the purchase of technical ability in the same light as the purchase of coal or bricks. "Drop in the salary, and the figure will work." But the discharge of the duties incidental to the office of a responsible managing or superintending appointment, are not of a mechanical turn-the-handle character, that one man can do as well as another; and a failure to appreciate this, is sure to lead to trouble and loss. The omission of any appreciation of the fact—especially in regard to highly-trained or educated candidates—that they are extremely sensitive and nervous, apt to flourish quickly in the sunshine of encouragement, kindness, fair dealing, and liberality, and to wither in the storms of misrepresentation, injustice, and tyranny, having human hopes, ambitions, faculties, and faults, is fatal to the best development of any industry.

The board usually commence by performing an operation of the very unsatisfactory character popularly described as putting the cart before the horse. They first fix on the salary to be offered, or which, in their own opinion, should be paid—a proceeding that is at once fatal to securing the highest order of ability. I would appeal to any manager or engineer of long standing as to whether he has ever seen, on the part of the board of directors, a desire to secure the best available talent in engineering, science, or commerce, and to pay a proper price for the same. A third-class fare will not secure a first-class passage; and the rate of salary as usually fixed is not sufficient to attract the highest order of ability. If they advertised for medical or legal advice at a fixed and very moderate fee, a certain number of replies would be received, but not from the really first-class members of the professions concerned. And first-class experts in any line are not to be secured in this manner. They can command their price, and do not need to compete for office at starvation rates. When directors and members of gas committees rise to a sense of the capabilities of the gas industry when put under the best obtainable technical and commercial control, there will be no lack of candidates to meet the demand. When the directors are willing to lay down a first-class fare, the first-class ticket will be ready to hand.

But all this by the way. Having fixed the price, they take a good deal of trouble to get (also in their own opinion) the best possible value for the money. If the works belong to a corporation, the special committee take the place of the directors, and the tendency to keep strictly to business is strongly accentuated. The average town councillor, like other persons who hold their positions on sufferance, is troubled with a kind of mental *strabismus*, due to being obliged to keep one eye on the business in hand and the other on the chances of retaining his seat. This is not the case with the director, who is fairly safe so long as he does not take advantage of the bankruptcy laws or otherwise lose caste. The councillor knows that a desire to save money is sure to "take on;" while he is not so confident as to the policy of recommending such a liberal scale of pay as is necessary to secure high-class services. The chances are that the gas committee changes more rapidly than the board; and therefore the special experience represented thereon is of a decidedly lower order. The councillor is usually touched a little with political or religious bias. It is all very well to say that all personal feeling is done away with, in these enlightened days. But the best gas engineer in the world, if known to be a Conservative in politics, would not stand at his best before a committee who were Liberal to the backbone; and an equally able man, having strong Radical tendencies, would be at some disadvantage before a committee of Tories. The question of a high order of ability or of special training, comes outside the scope of vision; and the indifference towards it is simply the result of ignorance, or of narrow-minded prejudice.

While all the members of the staff, from the office boy upwards, are required to show evidence of ability, the director or the member of the gas committee is frequently pitchforked into office on other considerations. If a foreman in any department, a time-keeper, or even a junior clerk is wanted, the candidate is required to furnish direct evidence as to character and ability. No managing board would agree to the appointment of a man—say, as carbonizing foreman—because he or his friends had a large holding of capital in the concern, or because he had been successful in business as a butcher or baker, or because he had influence with the local authorities. But a director, who has a voice in the management of affairs, who can *veto* anything and everything in the way of advancement or enterprise, or who can control the principal officers of the company, is more frequently selected from motives of policy—because he has a large holding, or is a wealthy or influential resident of the district—than for any special fitness or knowledge. If the list of shareholders happens to include gentlemen of special ability, the chances are that they may be offered a seat at the board; but usually the appointment is influenced by other considerations. The results of this custom are unfortunate in more ways than one, but especially as regards the trained technical staff, because ignorance and suspicion go together, and it is just the individual who is least capable of guiding the helm who assures

his colleagues that he does not sit in the board-room to be told what to do or to believe all he is told, but to exercise his own judgment. Fools will rush in where angels fear to tread; and the inexperienced director is the most likely to claim that he means to earn his fee, and to seek to control all sorts of things that should properly be left to the special experience and knowledge of the engineer and manager.

The average director, as a rule, has a very slight acquaintance with the purely technical side of the engineer's duties, and cares less. A gentleman who had sat at the board of a medium-sized gas undertaking for many years, was not aware that there was a laboratory and test-room at the works; and on being assured of the fact, wanted to know what it was for, and what benefit was secured by it. Being a retired tradesman, his idea of good management was based upon smart buying and energetic counter practice, and was apparently represented by fourteen hours a day hard work—mostly of a character that could just as well be executed by a young junior. And if a man came along who would put in fifteen hours, he would be considered the better of the two. Another director, also of several years' standing, happened to take a look round the works one day in August. At this season of the year, quite one-half of the plant would be idle. He was so strongly impressed by the quantity of apparatus out of use, that the result was a tremendous charge of extravagance against the manager, who he alleged had erected retorts and gasholders to the extent of 100 per cent. beyond the actual requirements. So the average director is apt to judge the manager and his duties in the light of the portion of them that comes under his direct observation. To him, the manager is the man who engages and pays the men, conducts correspondence, negotiates purchases, arranges extensions of mains, &c. He is a sort of cross-breed between an intelligent artizan and a smart clerk, rather than an expert and experienced technician; and any attempt to claim special knowledge of engineering or chemistry, is simply spread-eagleism, adopted with a view of justifying high emoluments.

What do the directorate or the committee know of the numerous details incidental to the maintenance of an ample supply of pure and good gas throughout the winter, of the arrangements necessary to the securing of a proper coal supply, of the chemical knowledge indispensable to efficient condensation and purification, of the care and watchfulness that must be exercised in regard to the labour question, of tact in dealing with dissatisfied consumers, &c.? And so, as has already been remarked, in some towns the gas manager is accorded his proper position as a professional engineer, in others he is looked upon and treated as a deserving working man. He may really carry the whole of the technical skill and experience of the company under his hat, while an influential board of directors appropriates the credit for the efficient carrying-on of the concern, and the man who really does the work waits outside the board-room, hat in hand, till he is wanted, and is not recognized in the annual vote of thanks to the directors for "their efficient management of the affairs." Some men must perforce put up with a lot of this sort of thing; but the young man of the first order need not, and will not. He is apt to look, not only at the remuneration, but at the position in society; and if he is to be tempted into the gas profession, some better security in this direction than is at present obtainable, must be offered.

One need not be surprised, under these circumstances, if a board of directors fails to take seriously a list of the qualifications which prove that the candidate has spent many years in training for an important post in a gas undertaking; that, under the not altogether safe impression that ability speaks for itself, he has plodded steadily through class-room, lecture-hall, laboratory, drawing office, engineering workshops, and so forth, until he is as perfect as may be in regard to every structural detail and method of procedure; and that he has not been satisfied to see one side of his subject, but has travelled and studied methods in different countries. The experienced technician would be able to assess the long list of qualifications at its proper value; but it appeals to the director's sense of humour, as an attempt to claim some fictitious advantages as compared with other candidates, rather than to his business instincts. And so the puzzled directors go over the list of applicants again and again. It would be too long a task to consider each one of seventy or eighty applications *in extenso;* and they do not know how to sift the wheat from the chaff. After coming down to the short list, their troubles are not at an end, especially if there has been close cutting over the salary to be paid. For one reason or another, the favoured individuals selected for a personal interview do not always improve on closer acquaintance. If really desirable candidates, their present employers will offer some inducement to withdraw their application and stay where they are. I have known as much as 50 per cent. increase of salary to be offered, which is a tacit admission that a fair remuneration was not previously paid. On the other hand, if the present employers appear too willing to allow the candidate to leave, there is an impression that all is not satisfactory. So, in the end, the board are glad to fall back upon somebody whom someone knows something about; and the selection is, to a great extent, a matter of chance or luck, while the candidate who knows he is on the whole better able to discharge the duties than the successful competitor, looks on with helpless amazement. Can we wonder if he propounds the question: "Is it luck or influence?"

(To be Continued.)

TECHNICAL RECORD.

MR. DIBDIN ON THE EFFECT OF QUALITY ON THE CONSUMPTION OF GAS.

The substance of a paper read by Mr. W. J. Dibdin, F.I.C., F.C.S., before the London Section of the Society of Chemical Industry on Monday last week was given in the following day's issue of the "Journal;" but in order to complete the communication, we publish to-day some of the tabulated results of the author's experiments on the effect of quality on the consumption both of coal and water gas, together with most of the incidental remarks which he made thereon, and which were not included in the paper. The tables given here are the only ones exhibited at the meeting.

It is only fair to the author to put on record his emphatic assurance that he had no particular object in placing the facts contained in his paper and the tables before the Society, other than to elucidate, so far as any efforts of his might serve to elucidate, the essential features of the question. He did not wish to prejudice in any way the minds of those present, or the minds of those who might afterwards read the paper, by trying to emphasize any point unduly; and if it seemed to them that any particular point in the paper was emphasized somewhat strongly, he asked them to take it from him at the start that it was merely the outcome of facts as they appeared to him to be facts. For what they were worth, he put them forward for those present and for those who read them, to form their own conclusions, and to criticize as severely as they could, in order that the truth, and nothing but the truth, might result from their deliberations. He said this in order to avoid any misconception that he desired to represent any faction or factions or set or parties in the controversy one way or the other. In this Society—a Society of scientific men devoted to unravelling those intricacies which they met with in daily life—they had but one desire, which was to wholly and solely arrive at the truth, however the result might affect their predilections one way or the other. Further on in the paper, Mr. Dibdin broke off to say that in the experiments he used 28 burners. The work was undertaken not for the purpose of elucidating the peculiarities of any particular burner; but to obtain an all-round average with the various burners commonly employed. He first used a standard London argand burner; then Sugg table-top burners, Nos. 4, 5, 6, and 7; Sugg slit-unions, Nos. 4, 5, 6, and 7; Sugg fishtails, Nos. 6 and 7; Bray fishtails, Nos. 4, 5, 6, and 7; Bray batswing, No. 6; and Bray slit-union, with codac economizer, about which there was a good deal to be said—very excellent results being found from this arrangement. Then followed Mints batswings, Nos. 6 and 7, an iron fishtail, a common butcher's burner, an imitation Bronner burner, Peebles burners, Nos. 4, 5 and 6, Sugg "F" argand, Welsbach "C" incandescent burner, and a Sunlight burner. He thought that in taking such a series as this, he had fairly covered the ground of the burners commonly employed by the public, and of which he had given some of the results—what might be called typical results. From these it would be seen that the conclusions were not based upon a few accidental coincidences. Remarking that everyone experienced in burners knew that there was a point at which a burner developed the maximum amount of light for the gas consumed, and beyond which they had a straining effect, and the ratio of light to consumption went down, he explained that, in these experiments, they started at the rate at which the burner gave the best effect. Of course, he did not pretend that in such a large number of tests as these—some hundreds in number—there might not be some accidental circumstances which affected the results. But where they had such a series of tests and drew diagrammatic curves, he did not think the general conclusions could be very far wrong. Another explanation was that, when the illuminating power of the gas was reduced below a certain point, it was impossible to burn all the gas required to get the same amount of light from the burner as with a 16-candle gas. What they did then was to burn just as much gas as the burner would properly develop. He also called special attention (here and later on) to the fact that far better results were secured with Welsbach burners when water gas was used than with any other class of burners. Speaking of the Widnes experiments, he mentioned that they were made with gas specially prepared by the admission of air, or by increasing the illuminating power with benzol. He admitted it was open to argument that there might have been exceptional circumstances in these particular experiments to influence the results; but he thought his diagrams and figures and subsequent experiments proved that exceptional circumstances did not exist. Commenting on No. 3 table, he pointed out that, with the standard argand burner, when using 12-candle gas, they had to burn 5·8 cubic feet, instead of 5 feet, to produce the normal intensity of 16-candle gas; and when the gas rose to 19 candles, they only had to burn 3·9 cubic feet. In the same way, if they took the Sugg table-top No. 4 burner, starting at 5·2 cubic feet for 16-candle gas, they had to burn 12·9 cubic feet of the 12-candle gas; while with 19-candle gas, the consumption was reduced to 3·8 cubic feet. The enormous difference between the 3·8 cubic feet and the 12·9 cubic feet would be observed. Then, if they took the Bray No. 4 fishtail, they had 15·1 cubic feet for 12-candle gas, 4·7 cubic

Consumption of Coal Gas of Various Qualities by Different Burners, under the Conditions named in the Paper (ante, p. 1395).

TABLE I.—WIDNES TESTS.

Burners.	Illum. Power.	11·2.	12·2.	13·5.	14·2.	15·2.	16·2.	17·2.	19·2.
Standard Argand	Cubic Feet of Gas Consumed	6·2	6·0	5·7	5·4	5·1	4·9	5·0	4·7
Sugg Table-Top No. 4		11·2	9·7	7·7	6·4	6·1	5·3	4·5	3·9
" " No. 5		9·5	7·8	6·2	5·7	5·5	5·3	4·6	4·1
Bray Fishtail No. 4		15·5	13 4	10·5	9·0	5·6	4·3	3·1	2·6
" " No. 5		14·0	10·6	9·8	6 8	5·9	5·0	4·0	3·2
Sugg "F" Argand		7·7	7·4	7·2	6·6	6·4	6·3	6·2	6·1
Welsbach "C"		4·9	5·0	4·0	3·7	3·5	3·5	4·2	3·4

TABLE III.—GASLIGHT AND COKE TESTS.

Burners.	Illum. Power.	12·0.	13·5.	14·5.	16·0.	16·5.	19·0.
Standard Argand	Cubic Feet of Gas Consumed	5·8	5·4	5·3	5·0	4·8	3·9
Sugg Table-Top No. 4		12·9	9·4	9·0	5·2	5·0	3·8
" " No. 5		10·4	8·0	7·4	4·8	4·7	3·7
Bray Fishtail No. 4		15·1	10·7	10·1	4·7	4·6	3·2
" " No. 5		14·8	8·8	10·3	5·4	5·2	3·9
Sugg "F" Argand		7·3	7·0	6·8	6·2	6·0	5·4
Welsbach "C"		3·3	2·9	3·2	3·4	3·3	2·5

TABLE V.—SOUTH METROPOLITAN TESTS.

Burners.	Illum. Power.	12·5.	14·5.	16·0.	16·5.	17·2.	18·0.
Standard Argand	Cubic Feet of Gas Consumed	5·5	5·3	5·0	4·8	4·4	4·3
Sugg Table-Top No. 4		6·6	5·9	4·5	4·4	4·3	3·5
" " No. 5		6·3	5·3	4·7	4·6	4·4	4·0
Bray Fishtail No. 4		6·9	5·3	5·0	3·4	—	2·8
" " No. 5		6·7	5·9	4·3	4·2	3·8	3·4
Sugg "F" Argand		7·1	6·4	6·0	5·8	5·6	5·3
Welsbach "C"		4·0	4·0	3·4	3·3	3·5	2·9

Consumption of Coal Gas and Admixtures of Coal and Water Gas by Different Burners.

TABLE VII.

Burners.	—	Pure Coal Gas.	Water Gas.			
		14-Cand.	20 p. ct.	48 p. ct.	73 p. ct.	100 p. ct.
Standard Argand	Cubic Feet of Gas Consumed.	5·2	5·3	5·6	5·4	5·4
Sugg Table-Top, No. 4		4·9	5·4	6·0	7·6	9·3
" " No. 5		5·8	6·9	7·6	8·8	9·0
Bray Fishtail, No. 4		5·6	6·8	7·6	9·6	14·5
" " No. 5		6·9	8·0	8·7	9·4	16·3
Sugg "F" Argand		6·5	6·7	6·8	6·8	6·8
Welsbach "C"		3·9	3·6	3·9	4·0	3·9

TABLE IX.

Burners.	Coal Gas.	Water Gas.	
	19-Cand.	27 p. ct.	75 p. ct.
Standard Argand	4·7	4·7	4·7
Sugg Table-Top, No. 4	4·5	5·7	7·3
" " No. 5	4·6	4·9	5·9
Bray Fishtail, No. 4	3·1	6·4	10·0
" " No. 5	4·0	5·0	11·1
Sugg "F" Argand	6·1	6·2	6·6
Welsbach "C"	4·2	3·3	3·9

TABLE XI.

Burners.	Pure Coal Gas.	Water Gas.	
		27 p. ct.	50 p. ct.
	16 cand.	17·2 cand.	18 cand.
Standard Argand	5·0	4·7	4·6
Sugg Table-Top, No. 4	5·4	5·7	5·0
" " No. 5	5·4	4·9	4·9
Bray Fishtail, No. 4	4·4	6·4	5·4
" " No. 5	5·1	5·0	4·8
Sugg "F" Argand	6·4	6·2	6·2
Welsbach "C"	3·5	5·7	4·0

feet for 16-candle gas, and only 3·2 cubic feet for 19-candle gas. When they came to the Welsbach burner, they obtained far more uniformity. With 12-candle gas, they had 3·3 cubic feet; with 16-candle gas, 3·4 cubic feet; and with 19-candle gas, 2·5 cubic feet. So that, with variable qualities of gas, the consumption was very much the same with the Welsbach burners; but, when they took ordinary flat-flame burners, the consumption rose enormously as the illuminating power decreased. With the Welsbach burner, it was almost impossible to get exactly the same amount of light on the photometer; the fluctuations were very considerable. In every case, they had to turn up the gas until they could get the maximum effect out of the mantle, and then the actual figure was stated. This was the way they worked the Welsbach; and it was the only practical way, because of the variations in the mantle itself. If they took pure coal gas of about 14-candle power, the Welsbach burner required 3·9 cubic feet to give its maximum intensity. When this was mixed with 20 per cent. of water gas, they had a consumption of 3·6 cubic feet; showing a reduction. But with 48 per cent. of water gas, the consumption was 3·9 cubic feet—the same as with pure coal gas; with 73 per cent. of water gas, the consumption was 4 cubic feet; with 100 per cent. of water gas enriched by petroleum to raise its power to 14 candles, 3·9 cubic feet were required. Therefore whether they used pure 14-candle coal gas or 14-candle water gas, the consumption required to produce unit light by the Welsbach burner was the same. This was satisfactory so far as incandescent burners were concerned. They found the same thing when they had another series of tests of coal and water gas of higher quality (19 candles). With coal gas of that power, the consumption was 4·2 cubic feet; with 27 per cent. of water gas, 3·3 cubic feet; and with 75 per cent. of water gas, 3·9 cubic feet. Here, again, the Welsbach burner showed, if not an advantage in one case, a distinct advantage in another. But the differences, having regard to the peculiarities of the Welsbach burner, were very slight; and, with this system, the water gas in varying ratios showed no disadvantages. It might be argued from this that, "if you can get water gas cheaper than coal gas, then have water gas." The standard argand behaved very much in the same manner as the Welsbach. Going to flat-flame burners, they found the consumption rising from 4·9 cubic feet to 9·3 cubic feet, 5·6 cubic feet to 14·5 cubic feet, 6·9 cubic feet to 16·3 cubic feet. Then the "F" argand showed fairly concordant results—6·5 cubic feet to 6·8 cubic feet. When they came to the richer gas, with a flat-flame burner, they found the consumption rising from 4·5 cubic feet to 7·3 cubic feet. These results made one think that if consumers were going to use a particular quality of gas, they must use a burner most suited to it. This was an old saying; and gas engineers would say he was only telling them an old tale. But he ventured to think this was the first time these facts had been brought out in this manner. At all events, he had now spent some few years in connection with this question; and he must confess to having been somewhat startled when he arrived at these conclusions. He was really not prepared to find there was such an enormous difference in the consumption required in burners of different values to produce unit light. It was a new departure; and therefore he felt justified in bringing these results before the Society for discussion. The essential facts were fairly before them.

The foregoing are some of the remarks made by the author apart from the paper; and they must be read, and the tables studied, in conjunction with the paper, the material parts of which were given last week.

Discussion.

The CHAIRMAN (Mr. Otto Hehner), in opening the discussion, said the first moral they might draw from Mr. Dibdin's experiments was that no direct relation existed between the nominal illuminating power of gas and the illuminating power of gas as it was generally consumed. The second moral was "Use Welsbach burners," because they gave a fairly equable illuminating power. If Welsbach burners were an established institution for the future—if they had come to stay, as he heartily hoped they had—then they could at once conclude that their present ideas of illuminating power were all nonsense, and the sooner they dropped making coal gas with illuminating power at all the better. The third moral was, that if they did not choose to use Welsbach burners, they must take to argands, and eschew flat flames. Mr. Dibdin had told them a great deal more than that. If consumers got 16-candle gas, and obtained light of equal value, and if this was changed by Act of Parliament to 14 candles, to say that all they had to do was to adjust the proper payment by diminishing it by two-sixteenths, well (as Mr. Dibdin had showed) no greater fallacy than that could be perpetrated. The matter was of the utmost importance not only to the public, but to all consumers of gas.

Dr. PERCY F. FRANKLAND, F.R.S. (Birmingham), was sure all present must have considered it a great privilege to have had the pleasure of hearing Mr. Dibdin give the results of his extensive experiments. As they all knew, probably there was no one living who had had so much experience (practical experience) as Mr. Dibdin in connection with the illuminating power of gas—how it was developed, and upon what principles the burners and so forth must be constructed. These experiments all led to the conclusion—and he thought they might be summarized in this one sentence of Mr. Dibdin's—that "a gas of higher price but of higher quality might be far cheaper to the consumer than a gas of lower price but lower quality." This was a fact which had been long known. He (Dr. Frankland) might say that he had known it almost from his earliest days, because his late father (Sir Edward Frankland) was always very eloquent on this point. In his experimental researches as early as the year 1876, or before that, he distinctly enunciated this fact: For instance, in

London at that time, and before that time even, there were two kinds of gas being circulated in the mains—one coal gas of nominally 16-candle power, and in other mains cannel gas of about 27-candle power. Of course, the cannel gas was sold at a much higher rate than the coal gas; yet, as the result of his experiments, it was distinctly shown that the cannel gas was far the cheaper for the consumer to use than the ordinary coal gas. He could remember that his father was desirous of taking a house in a part of London that was supplied with cannel gas, so enthusiastic was he about the use of this high illuminating power gas, compared with gas of lower power. However, just as he was in search of such a house, the cannel gas was cut off by the Company; and it was then impossible for the ordinary consumer to get cannel gas at all. At present, the whole of the gas supplied to the Metropolis was coal gas, and no cannel gas. Now in 1876, the nominal illuminating power of gas was 16 candles; and it was nominally 16 candles at the present day. At an earlier period—in 1851—the gas was, he believed, nominally 14-candle. The general population of London was thus under the impression that between the years 1851 and 1876, a very important increase in the illuminating power had been made by the Gas Companies. But in 1876, his father tested the London gas with the same burner that was used in 1851 for the official testing of the gas; and it was found that the gas of 1876 had no greater value than the gas of 1851 when tested with the same burner. The increase in the nominal illuminating power of the gas was due entirely to the improvement in the testing-burner. The gas was tested in 1876 by the argand burner; and it was this that led to the so-called improvement of the gas supply of London. They had that evening obtained evidence that the standard argand burner developed a large amount of illuminating power out of poor gas which the flat-flame burner which was used in the official testing of gas in 1851 was incapable of doing. This was really the point of the whole matter. The important thing in connection with this question of gas and illuminating power was to use such a burner as would develop the maximum amount of light out of the particular gas which was being supplied. He should like to say here that the material from which Mr. Dibdin's conclusions were drawn was so enormous that it was difficult to grasp the whole situation at once; but with extreme ingenuity, the author had grouped all the results in a single diagram.* He (Dr. Frankland) was closely associated with the author at the time of his earlier experiments; and he must confess, when Mr. Dibdin made this diagram in which all the experiments were summarized, and the results seen at a glance, it seemed to him to be a masterpiece of lucidity. These experiments had involved an immense amount of trouble. It was very easy to experiment upon a number of different burners at one and the same time on one and the same gas, which happened to be the same gas that was supplied in the experimenter's laboratory. But these experiments had been made with gas of different illuminating powers; and a large number of different burners had been tested with each of these special gases. This had involved the arduous preparation of gases of particular illuminating powers on an extensive scale, in order that this comprehensive series of experiments could be made. Therefore, he thought, they were particularly indebted to Mr. Dibdin for having carried out the experiments which brought before the public in such a forcible way the importance of illuminating power to the individual consumer, and enabled them to see that the intrinsic illuminating power was not always the nominal illuminating power. As the Chairman had said, of course if the incandescent burner were universally used, it would be a matter of little importance what the intrinsic illuminating power of the gas was. Indeed, from the interesting latter experiments of Mr. Dibdin, it appeared that the non-illuminating gas—the gas which was for the most part composed of water gas—was more advantageous by far than the ordinary coal gas for the development of light with the Welsbach burner. He (Dr. Frankland) did not know what the experience of most chemists was, but the result of his own experience in connection with Welsbach burners was that he should like to have as few as possible. They were distinctly troublesome to keep in order; and the mantle used was never giving its full light just when it happened to be most wanted. The burners, however, had one great advantage—that, for a given amount of light, they did not pollute the air so much as ordinary burners. But for this reason, he should not use them at all. As a matter of fact, he used them because, if he had one Welsbach burner alight, the air was tolerable; but if he used two or three ordinary flat-flame burners, it became intolerable. He did not think anyone could contend that Welsbach burners were by any means the universal fashion in the streets of London. They were rarely seen; and the lights were generally flat-flames, and of low quality too. Now, he thought, nothing could be more startling than the extraordinary way in which the volume of gas had to be increased in order to produce a given amount of light with ordinary flat-flame burners when the illuminating power of the gas was diminished. In houses and workshops, if the illuminating power of the gas fell short, more burners were needed to produce the same amount of light; and they saw by Mr. Dibdin's figures what the effect of this was. If the illuminating power of the gas was diminished from 16·2 to 14·2 candles, the consumers did not have to pay merely a very little more for the gas, but they had to pay enormously more for it. With a small diminution of the intrinsic illuminating power, the gas bill was doubled. While flat-flame burners were in vogue (and he should say in general life they were almost exclusively in vogue), any diminution in illuminating power was a distinctly retrograde movement. It put into mind that they were going back not only to the nominal illuminating power of the gas distributed in 1851 before the 16-candle gas came into vogue, but they were really going back to a gas of inferior power to the gas distributed in 1851, because if that gas had been examined by the standard London argand, it would have been 16-candle gas, just as now. This was what they were actually confronted with at the present day—that they were going back to a quality of gas inferior to that distributed in London in 1851. What was more, it was also of very great importance that the gas should be of constant illuminating power, because, as they had seen, each burner was adapted to gas of a particular power, and it gave different results if there was any diversion from that power. But the order of the day was that gas was to be varied from a certain illuminating power. Regarding the paper generally, he thought the points brought out in connection with water gas were perhaps the most instructive and novel of all.

Mr. T. FAIRLEY (Leeds) hoped that some of their friends who took the view of the gas companies on this question would join in the discussion, and so give more heart to it. Dr. Frankland had so well gone into the points that he (Mr. Fairley) might have discussed, that it left him little to say. The work that he had personally done in gas-testing had been more in relation to the heating power; but before he mentioned the conclusions to be drawn from this work there were one or two points in the remarks of both Mr. Dibdin and Dr. Frankland that might be summarized—(1) that flat-flame burners throughout were best for gas above 16 candles; (2) that argand and Welsbach burners were best for low-quality gas below 16 candles; and (3) that, when they were trying to estimate the value of a gas for lighting, they must think, however difficult it might be, of a definite quantity of light—they wanted so many cubic feet of gas, of a certain power, and of a certain price. These three items must come in; if they only had one or two of them then they misled themselves. In speaking of the heating power of the gas, he had not found the same differences per candle power that Mr. Dibdin had found in using different burners. In fact, the relation of heating power to lighting power for ordinary coal gas might be put in a kind of algebraic formula—that was to say, they had in all gases a certain proportion of non-luminous constituents—non-luminous coal gas, that might give about half its heating power; and the rest (the other part of the heating power) was due to the lighting constituents. This part was a multiple of the candle power. They could find the factor, which, added to the constant number, gave the total thermal units—British or such other units as they chose to use—from the lighting power. Now some persons in speaking of this, had tried to show that the heating power went down in proportion as the lighting power went up. Apparently this was so. Suppose he called B.T.U. $= M\,c.p. + C$. If they divided the whole sum by the candle power, it was obvious that the right-hand term $\frac{C}{c.p.}$ (C being constant) became less as *c.p.* (the candle power) increased; and therefore the apparent number of heat units per candle power went down. But if they put it in an actual concrete form, his experiments, so far as they extended, gave them some number like this—

$$\text{B.T.U.} = 23{\cdot}5 \times c.p. + 275.$$

The B.T.U. might be computed by the candle power multiplied by the 23·5, while the constant 275 might be regarded as representing the non-illuminating part of the gas. If they divided such a fraction as this by the number of candles, as the candle power rose, the apparent number of units per candle power went down, because the number 275 did not increase with the candle power. No argument was to be drawn from this fact in favour of the lowering of the illuminating power of the gas; but Mr. Dibdin had well proved that, with ordinary flat-flame burners, gas of low illuminating power was the most costly they could have.

Dr. P. DVORKOVITZ said the question the author had raised was of great importance. As probably all present knew, the South Metropolitan Gas Company applied to Parliament last session to be allowed to distribute to the consumers gas of 14-candle power, instead of 16 candles. But steps had been taken (thanks to the previous experiments of Mr. Dibdin) which proved that, though the Company professed to supply 16-candle power gas, the consumers only received 14-candle gas. From this it was argued, "Well, the consumers have had 14-candle gas up to now, they may continue to receive it by Act of Parliament." Mr. Dibdin's experiments had absolutely proved that, with 14-candle power gas, a consumer would have to pay nearly double the amount for the light which he used; and to this the utmost importance should be attached. His experiments had also proved the fact that the higher the illuminating power, the cheaper was the illuminant to the community. It was quite true that there were some burners which were used for testing purposes—viz., the argand, and the same might be said of the Welsbach—which produced good results with either rich or poor gas; but, as Mr. Dibdin had explained, and as they all knew, there were not many consumers in the United Kingdom who used standard argand burners, and a very small percentage

* We are unable, at all events at present, to publish this diagram; but it was the one exhibited in the Parliamentary Committee Room during the consideration of the South Metropolitan Gas Company's Bill last session.—ED. J.G.L.

of the consumers were employing Welsbachs. At the same time, the results of the experiments had shown them that, with ordinary flat-flame burners, if given rich gas, the consumers always had value for money. His own connection with the gas industry had been a long one; and he was quite sure the interests of the gas companies themselves lay in the direction of not reducing the illuminating power. Mr. Dibdin had made experiments with water gas enriched with petroleum vapours. He hoped that he would continue his experiments with carburetted water gas as supplied; and then, he (Dr. Dvorkovitz) thought, the result obtained would be different. All his own experiments with water gas enriched by petroleum vapours or enriched by petroleum gas were quite different; and if Mr. Dibdin would make experiments with water gas which was produced now by the various systems introduced into gas-works—water gas of 19, 20, or 22 candle power—he would find it would give a result quite different to that which he obtained by the so-called carburetted water gas which he used. The combustion in burners of the petroleum vapours would give a different result from what would be obtained with water gas enriched by actual petroleum gas. This contained a large quantity of aromatic hydrocarbons which produced a high illuminating power, while petroleum vapours did not contain aromatic hydrocarbons; and, in combustion, they produced different results altogether. The diagram and the figures presented by the author showed distinctly what a consumer would gain if, instead of gas companies trying to reduce the candle power, they would try to increase it. If they took the statements of gas engineers who used carburetted water gas, a positive candle-power only cost ½d.; so, if they spent 1½d., they would be able to supply the consumers with 19-candle power gas, which would be, as Mr. Dibdin had conclusively shown, the cheapest illuminant possible.

Mr. R. G. Grimwood (London) said one of the most interesting points Mr. Dibdin had brought out in the paper was the peculiar influence which water gas exerted on the relation between illuminating value and the quantity of gas consumed. This was a most important matter, because every day the proportion of water gas introduced into gas supplies was gradually increasing in England. On looking down the tables, he found from Table VII. that, where coal gas and water gas of equal illuminating power were mixed together in varying proportions, the mere addition of 20 per cent. of water gas involved an increasing consumption to obtain the normal illuminating value from the burners. He had taken the average of the whole lot; and he found that it entailed an increase in consumption of 10 per cent. If they took what was undoubtedly the most common burner in England (the Bray No. 5 fishtail), it involved an increase in consumption of no less than 16 per cent. over what would be required if ordinary coal gas enriched with petroleum was used. He might say at once that this was water gas made on the most modern principle, and was water gas as supplied from the very best plant that could be obtained. It was quite normal water gas, in fact; and there was no suspicion of its being enriched after it had been made. Looking at Table XI., where water gas was employed in the manner in which it was ordinarily used—that was to say, as an enriching agent—he found, where a mixture containing 27 per cent. of water gas was used, which enriched the gas from 16 to 17·2 candles, the mean normal illuminating value for this series of burners required 5·6 cubic feet of gas per hour. Now that was for 17·2 candle gas, containing 27 per cent. of water gas. On referring to Table I., he found that for 17·2-candle gas the mean normal illuminating power only required 4·6 cubic feet—that was to say, the mere addition of 27 per cent. of water gas entailed an increase in consumption of over 20 per cent. This was certainly a most startling statement; and it was not an individual result. Some of these things were so peculiar, that in making the experiments they could scarcely believe them, and the tests were made all over again. Another way of looking at this was that 17·2-candle power gas, containing 27 per cent. of water gas, gave no more illuminating value than 15·8-candle coal gas, or coal gas enriched with petroleum. This was certainly a point which required their very careful consideration, since no restriction was placed on the gas companies as to what amount of water gas they should put into their supplies. There was another point, and a most interesting one (but Mr. Dibdin could not do everything), as to what would be the effect of adding (say) 10 per cent. of 40-candle power water gas to an ordinary coal gas (say) of 14-candle power, which would raise it to 16·6 candles. So far as one could see in this work, it did not seem that it was the luminous portion of the water gas which had the effect he had been referring to; it appeared to be more the water gas itself. Of course, 27 per cent. was fairly high; but it was not more than occurred in many of the gas supplies in England. Further evidence was required on another point which Mr. Dibdin had mentioned, and which was brought prominently forward in this matter—as to the uselessness of making any comparison of the price of gas without taking into account the illuminating value. Being interested in this matter, he had been looking up the London County Council report on the illuminating power of the gas supplied to London, as tested at the testing-stations; and he found, taking the mean of the year, that the Gaslight and Coke Company's gas was 15·7 candles, whereas the South Metropolitan Company's gas was 14·6 candles. Now, looking at the author's diagram, he found that this difference of 1·1 candles represented a difference of 5d. in illuminating value; and before they could make any comparison of price between the South Metropolitan gas and the Gaslight and Coke Company's gas, they had to add 5d. to the price of the former. This paper had opened up many new points, and points which required very careful consideration—in fact, during the year, many new matters in connection with gas supply had come to light. The fact that no restriction whatever was placed on gas companies as to the amount of water gas they should put into their gas supplies required some attention. As an illustration, he might say that the other night 17·2-candle gas was found in London with a bare 2-inch flame. This was not got without a large addition of water gas; and there was no restriction. It was acknowledged that a large percentage of water gas was detrimental to health; and Mr. Dibdin had proved that it was certainly most detrimental to consumers' pockets. The whole question demanded that some impartial body—some body like the Board of Trade—should hold an inquiry at once, and make an effort to settle these many points, which were points of dispute and of discussion between scientists and consumers and the gas companies.

Mr. Isaac Carr (Widnes), who had been invited to attend, sent instead a communication on the subject, which was read by the Secretary. Mr. Carr had assisted Mr. Dibdin in the experimental research work at Widnes mentioned in the paper, and was in accord with the conclusions adduced as to the lighting value of coal gas of varying quality when consumed in the ordinary flat-flame burners common to the consumers of to-day. The difference of 9d. per 1000 cubic feet in the selling price of gas by the two great London Companies was, he remarked, at the present time the subject of dissatisfaction and discussion. While there was no denying in one sense the hardship of the position of the consumers of the Gaslight Company, who were paying 3s. 5d. per 1000 cubic feet as compared with the 2s. 9d. of the South Metropolitan, yet the important fact that the former price was for 16-candle gas and the latter for 14-candle gas did in great measure appear to be lost sight of. The writer had found that the light-giving value of 14-candle gas in the best type of flat-flame burner required 32 per cent. increase in consumption to give the same light as 16-candle gas; and this with gas at 2s. 9d. per 1000 cubic feet, amounted to 10d. per 1000 feet. He had stated that the position of the consumers on the North side of the river was a hardship as compared with that of the consumers on the South; and he did so on the ground that the cost of enrichment to the Company did not bear a proportionate relation to the loss sustained by the consumer in the reduction in quality—*i.e.*, while the Company might keep up the quality from 14 to 16 candles at the additional outside cost of 1d. per candle per 1000 cubic feet, the loss to the consumer by reducing the quality from 16 to 14 candles for ordinary lighting purposes was 5d. per candle per 1000 cubic feet. At the same time, the consumers on the South side paid dearly for his so-called cheap gas when the loss in lighting efficiency was taken into consideration. The economic standard of burner duty with gas of varying quality had an important bearing on this matter from the consumer's point of view. With the best ordinary batswing and fishtail burners and 20-candle gas, the consumer obtained 4 candles per cubic foot, yet a batswing burner of the most suitable kind—Bray's No. 6 special—when consuming the London 16-candle gas yielded only 2·66 candles per cubic foot, or a falling off of 33·5 per cent. in effective duty. The highest economic duty the writer had obtained with 14-candle gas and a Bray No. 6 special batswing burner was 1·9 candles per cubic foot, or a further falling off of 32 per cent. The writer did not, however, agree with the author in describing the use of incandescent lighting as limited. On the contrary, this system of lighting was becoming very general, and with the recent reductions in the price of both burners and mantles, it was, in his opinion, highly probable that the amount of incandescent lighting would in a few years' time exceed that of the flat-flame. Until, however, the flat-flame burner was entirely superseded by incandescent lighting, the serious loss in lighting efficiency inflicted on users of flat-flame burners by low-grade gas must continue. Low-grade gas also affected adversely every type of burner such as incandescent, gas for heating, cooking, and motive power purposes on account of the reduced calorific value, although the proportion of falling off was very much less than in the case of flat-flame burners. For these purposes, the writer found that for each candle the gas was reduced in illuminating power, about 3 per cent. increase in consumption was required.

Mr. D. A. Sutherland (London) spoke of his experience in Glasgow and London, and advocated the use of regulators to enable the consumers to govern the gas at the burners. In connection with Dr. Frankland's remarks, he said that, being of an economical turn of mind, he invariably in London used incandescent lights, because he could not carry on his work in winter without a white light; and he could not afford the electric light. He also found the incandescent light very useful in his house. He changed his incandescent mantles every month. They only cost 6d. each; and the difference they made in the gas bill was very great. Another thing, to ensure good results, the burners should be occasionally blown out. In experiments of the kind undertaken by Mr. Dibdin, a great deal depended on the temperature and pressure; and he would be much interested to know at what temperature these tests were made. A great difference might have arisen through the work being carried out in the summer or the winter. It was impossible to calculate

the variations in carburetted water gas. Though the gas might have been controlled at the beginning, the change in temperature in the same day might have been very great.

Mr. CLAYTON BEADLE (Erith) remarked that one of the great practical objections to the Welsbach light was the rapid rate of destruction of the mantle. But Professor Lewes had described a new mantle made of Lehner silk instead of cotton fabric, which had lasted 3000 hours, as against 600 hours with the ordinary mantle. If the new mantle proved as good as the preliminary trials gave hope for, it would certainly go a long way towards making incandescent lighting a practical success.

Mr. R. WATSON (Hertford) asked for information as to the point at which the air was introduced to produce the lower qualities of gas—the 11·2-candle gas, the 12·2-candle, and so on. Surely this must to an extent oxidize a certain percentage of the gas which would furnish no heat, and would falsify the results so far as the actual consumption of gas was concerned. It seemed to him that the true moral to be drawn from the figures before them was that the consumer should be educated to use the correct burner for the gas supplied, and not take any burner that might happen to please his fancy so far as appearance or popular opinion was concerned. It would seem, judging by the figures, that there was very little variation between 14 and 16 candle gas when an argand or a Welsbach burner was used; and the question of price as between 4·9 cubic feet of 16·2-candle gas and 5·4 cubic feet of 14·2-candle gas was a comparatively small one—not more than 10 per cent. of the actual value.

Mr. DIBDIN, called upon by the President to reply to the discussion, said he did not know what he had to reply to. He assured those present that he considered it a great compliment there should be practically nothing to answer. He had expected that he would have had considerable pulverizing going on there that night; that he would have been shown that his conclusions were utterly fallacious; and that his was an altogether nonsensical inquiry. But from the tone of the discussion, he believed he was not far off the track; and, this being so, he thought it was a very serious track. He had hoped there would have been some justification for the statement that had been made, that it was an economical thing to the consumer to be supplied with low-grade gas, because, if he used a good burner, he could get better illuminating value than with 16-candle gas. Some very funny statements had been made; and he (Mr. Dibdin) was sorry the makers of those statements were not there to justify them. All those who were concerned in the question had had a copy of the paper, and had been invited to attend the meeting to state their views, and fairly argue the question out. If they declined to come and discuss the matter, nothing more could be said; and they could only leave the matter to the judgment of the public at large when they had the whole of the facts before them. He did not say this because he wished to establish any one point. It was well known there had been much controversy on this question. He did not think the controversy was settled; and all honest-minded men would have it settled on the lines of truth, and truth alone. One question that had been asked was as to the character of the water gas used in these experiments. It was water gas enriched in the process of its manufacture—that was to say, the charge of oil was placed in the retorts, and the oils were cracked in the usual way. It was not that a simple water gas was first made, and then enriched with the vapour of petroleum; but the petroleum oils were cracked in the process of manufacture. Mr. Carr had referred to the question of the London gas. Of course, the London gas question was a very important one; but he did not wish to emphasize it again. He did not care about London gas or Manchester, Birmingham, or Liverpool gas, or gas from elsewhere. He had put these facts before them as scientific truths, obtained by much patience and care. Whether they applied to London or to Kamtschatka, he cared not one jot. Mr. Carr thought that incandescent lighting was not limited. Well the question of limitation was, after all, a relative one; and undoubtedly a very large number of incandescent burners were used. He thought himself they would continue to be used; and with improvements in mantles, they would be, if not entirely, almost entirely in the future, the only class of burners which would be employed. Although they could hope that in the future something better might be done, it was not wise to neglect the existing position of the question. If one went through the country, into large towns, small towns, or where one would, the common flat-flame burner would be seen pretty well everywhere. Enormous manufactories would be found lighted with flat-flame burners, and in street after street how many incandescent burners would be seen? A few might be found in the principal thoroughfares. Then in the ordinary rooms of houses, flat-flame burners of various kinds would be found; and there were many places in which the present mantles could not be used with advantage because of vibration and draught. He had had them placed in his own laboratory; but, with all the good will in the world for the advance of the gas industry, he had been compelled to put them on one side, and revert to flat-flame burners. There were places in which mantles could not possibly be used; and he felt justified in saying that at present throughout the country the use of the incandescent mantle was very limited in regard to the total quantity of gas which was consumed for luminous purposes. As to how the gas employed in the experiments was enriched with petroleum vapour or benzol, in order to increase its illuminating power, the method in one case was to mix the benzol while the holder was filling. Pentane was employed in one instance. This was put into the holder, and allowed sufficient time to diffuse throughout the whole. It was well known that, in an hour or two, even with atmospheric air, they would get petroleum vapour thoroughly diffused, and find the gas of even quality. This was, in fact, how Mr. Vernon Harcourt proposed to produce his standard pentane gas for hisstandard burner. The same method was employed in these tests. The petroleum vapour instantly diffused; and in the course of an hour or two, the mixture was complete—sufficient time was allowed for the mixture to become thorough. As for the temperature, he thought it would be taken for granted that it was carefully noted in every case; and corrections were made not only with regard to the volume of gas manufactured but used at the time of the test, and corrections made as to the illuminating effect. The experiments at the Southwark gas-testing station were made in a room which was kept constantly, day and night, at 60°, in order that the testing of meters might be made under the most advantageous circumstances; so that there were no exceptionally favourable or unfavourable conditions. All these points were noted at the time; so as to get at the truth as near as possible. The observation as to the possibility of there being a new type of mantle was very interesting. He should be delighted to hear that they had a mantle which was going to last a good many more hours than the one they had at present. If they had a new mantle which would take the place, under every circumstance, of the ordinary flat-flame burners, he should be the first to consider the man a fool who continued to use any other form of burner than the incandescent; but when they had to put on mantle after mantle, then he said the man was not a fool who still employed flat-flame burners. There were many places where it was impossible, where it was not advisable, to use such delicate things as mantles—in fact, they could not be used on account of constant breakage. This being so, one was compelled to use the burner that could be employed; and that was, in a large number of cases, the flat-flame one. As to the method of introducing air into the gas, there was only one case in which that was done; and it was in the Widnes experiments. It was done to tenuate the gas. In that instance, a small side cock was opened, and a little air drawn in. For the same purpose, the Gaslight and Coke Company's gas was passed through a coke scrubber moistened with oil; but with the South Metropolitan Company's gas, he had no occasion to do this.

The CHAIRMAN said Mr. Dibdin had put a matter of the highest consequence before them in a very fair manner. If he had erred at all, it had not been on the side of exaggeration. He regretted very much with Mr. Dibdin that the managers of gas companies, especially of the London Companies (one of whom had recently obtained an Act of Parliament in favour of lowering the illuminating power of their gas), had not thought it worth while to appear at the meeting to refute Mr. Dibdin's statements. The Company referred to had managed to get a lowering of their illuminating power without the whole question being made clear to all those who were interested in consuming the gas. It was all very well to use Welsbach burners. They had all tried them, and had come to the conclusion that they were most admirable, and would no doubt become to be more used in a short time. But Mr. Sutherland had stated that he put on a new mantle once a month; and he (the Chairman) dare say he put on a new one even more frequently than that. Thirty days at six hours a day was a long time. Each burner passed 4 cubic feet of gas per hour; so that each mantle would use 720 cubic feet during its existence. Supposing the cost of this quantity of gas was 21d., and they added the cost of the mantle (say, 6d.), this 6d. was a large proportion on the cost of the gas—a much larger proportion than the drop in the price of the gas, which, in turn, hardly corresponded with the drop in illuminating power. As to the Lehner mantle, it certainly could not be weaker than the Welsbach mantle; consequently it must be stronger. (Laughter.) Certainly it gave an excellent illuminating power. He was absolutely convinced that, although the incandescent light which was at present in vogue had caused an immense progress in lighting generally, it was only in an ephemeral or intermediate stage. He felt satisfied that before many years were over, the incandescent mantle would be as different from that of 1900, as the 1900 one was from that of 1885. At the present time, perhaps, the greatest disadvantage under which they were labouring in regard to progress was that the Welsbach Company's patent did not expire until 1907. On the Continent, on the other hand, the patents were no longer in force, prices were lower, and the mantles were much more generally used. While the great bulk of the gas used for illumination was consumed in ordinary burners, it was absurd, and it was disastrous to disregard the proportions which existed between illumination and consumption, as shown so clearly by Mr. Dibdin. Until they reached the ideal time when the heating effect solely would be utilized for producing illuminating power (which was not now the case), they had to reckon circumstances as they were. He should like to echo what Dr. Frankland had eloquently put—viz., the fact that Mr. Dibdin had made so little of the enormous labour involved in his work. When they considered that he had operated on 28 burners with a great number of gases of different illuminating powers and different mixtures, they could calculate how many transmutations and permutations were necessary, and how many thousands of observations had had to be made before he could generalize and show the results in these figures.

THE DETERMINATION OF CARBONIC OXIDE IN GAS.

The objections raised to the presence of more than a moderately low proportion of carbonic oxide in illuminating gas, have directed attention to systems for its determination; and the following account of a new method, which has been devised by Heeren A. Smits, H. Raken, and P. C. E. Meerum Terwogt, in the laboratory of Amsterdam University, will therefore prove interesting. It has been fully described in recent numbers of "Het Gas" and the "Zeitschrift für angewandte Chemie."

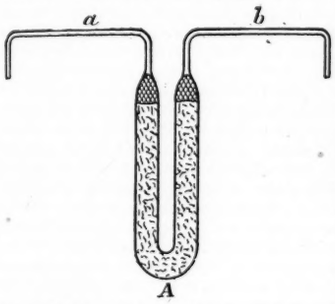
M. Nicloux, in 1898, proposed to determine carbonic oxide in air by passing the air over iodic acid heated to 300° Fahr., whereupon the carbonic oxide becomes oxidized to carbonic acid, and iodine is liberated, according to the equation—

$$5\,CO + 2\,HIO_3 = 5\,CO_2 + H_2O + I_2$$

The iodine is carried forward and absorbed by solution of caustic soda, in which it is determined by a colorimetric method. The quantity of iodine liberated is a measure of the amount of carbonic oxide in the air passed over the iodic acid. M. Gautier modified this method, with good results, by passing the air over iodic anhydride (iodine pentoxide) at from 150° to 160° Fahr., and absorbing the iodine and carbonic acid liberated by caustic potash free from carbonate. The iodine is then determined by titration, and the carbonic acid by the volumetric method of Müntz and Aubin. MM. Nicloux and Gautier found that hydrogen and methane did not act on iodic acid or anhydride; but that ethylene and acetylene did slightly. Consequently, ethylene and acetylene, if present, must first of all be removed by means of fuming sulphuric acid.

This very delicate method of estimating traces of carbonic oxide in air is evidently applicable also to its estimation in illuminating gas. But in gas analyses where more than mere traces of carbonic oxide have to be determined, it cannot be used. The authors have therefore endeavoured to devise a method for the volumetric determination of that gas by means of iodic anhydride, with the following results.

The apparatus comprised a pipette (very similar to Hempel's palladium pipette), containing about 8 grammes of iodic anhydride. Thus a U tube, as shown in the annexed figure, is filled with iodic anhydride and asbestos; plugs of asbestos being placed where the narrow tubes *a* and *b* are fused on. The tube *a* is connected with the gas burette; the tube *b* with the potash pipette. On leading gas that has been freed from carbonic acid, heavy hydrocarbons, and oxygen through the iodic anhydride pipette (U-tube) after it has been raised to a temperature of 300° to 350° Fahr., the iodine set free sublimes in the tube *b*, and the carbonic acid is absorbed in the potash pipette. Proceeding thus, it was observed that stoppages due to the sublimation of iodine in the tube *b* readily happened; but it was found possible to get over this trouble in the following manner: At the start, the gas was passed rapidly to and fro through the iodic anhydride pipette, and then more slowly, whereupon the iodine sublimed in the two tubes *a* and *b*, and a stoppage was avoided. As the carbonic oxide in this manner becomes completely oxidized to carbonic acid, which is taken up in the potash pipette, the contraction found, after the iodic anhydride pipette is cool, corresponds to the quantity of carbonic oxide present in the gas. The tension of iodine vapour is so inconsiderable that it may be left out of account.



In order to make the pipette ready for a second determination, the sublimed iodine must be removed from the tubes *a* and *b*. This may be easily done by warming each tube while a slow current of air is passed through.

To confirm the observation of MM. Nicloux and Gautier that hydrogen and methane do not react with iodic anhydride at 300° Fahr., some experiments were made on mixtures of carbonic oxide and hydrogen and carbonic oxide and methane. It seemed possible that the nascent iodine might attack the hydrogen or methane; but the following results disproved this supposition:—

	Hydrogen.	Carbonic Oxide.	Methane.	Carbonic Oxide.
Taken	72·6 c.c.	8·8 c.c.	42·8 c.c.	8·0 c.c.
Found	72·7 „	8·7 „	42·7 „	8·1 „

These figures further show that the new method is very exact, and that at 300° neither iodic anhydride nor nascent iodine acts on hydrogen or methane.

With regard to the results actually obtained in working, it will be remembered that when the palladium pipette only is used, merely the quantity of methane found requires a small correction. When working with the iodic anhydride pipette as well, a correction must be applied to the quantity of hydrogen as well as that of methane. For instance, supposing 100 c.c. of coal gas are taken for an analysis, and that there are successively absorbed—

a c.c. by the caustic potash pipette
b „ „ „ fuming sulphuric acid pipette
c „ „ „ phosphorus pipette
d „ „ „ iodic anhydride pipette
e „ „ „ palladium pipette

and that in *f* c.c. of residual gas, *g* c.c. of methane is found, then the actual percentages of hydrogen and methane are arrived at in the following way: Let p = the free space in the iodic anhydride pipette and q = that in the palladium pipette, and $A = 100 - (a + b + c + d)$. Then, after the absorption of carbonic oxide, the volume of the gas enclosed = $A + p$ c.c., consisting of A c.c. of gas and p c.c. of air, because the iodic anhydride pipette, filled with air, was placed in communication with the gas burette, and the quantity of air naturally remained unaffected during the absorption of the carbonic oxide. When, however, the gas burette is put out of communication with the iodic anhydride pipette, and is connected with the palladium pipette in which is q c.c. of air, then A c.c. of gaseous mixture from the burette is mixed with q c.c. of air. If the whole of the residual gas were diluted with air in the same proportion, then the total volume ought, according to the equation—

$$A : A + q = A + p : x$$

$$x = \frac{(A + p)(A + q)}{A}$$

to amount to $\frac{(A + p)(A + q)}{A}$ c.c.

Let the contraction found in the $(A + q)$ c.c. of this gas, owing to the palladium absorption, be = e c.c. Then the contraction for the total quantity of gas would be

$\frac{e}{A}(A + p)$ according to the equation

$$A + q : e = \frac{(A + p)(A + q)}{A} : x$$

As the iodic anhydride pipette, as well as the palladium pipette, was filled with air, the contraction does not coincide exactly with the proportion of hydrogen, as the oxygen of the air has been consumed in the partial oxidation of the hydrogen by the palladium treatment. The contraction consequently is $\frac{p + q}{5}$ too much; and the actual percentage of hydrogen is therefore—

$$\frac{e}{A}(A + p) - \frac{p + q}{5} \quad (1)$$

The actual residual gas before the hydrogen absorption amounted to—

$$\frac{(A + p)(A + q)}{A} \text{ c.c.}$$

The total contraction $\frac{e}{A}(A + p)$, and the mixture of gas remaining behind, should therefore have amounted to—

$$\frac{(A + p)(A + q)}{A} - e\frac{A + p}{A} = \frac{A + p}{A}(A + q - e) \text{ c.c.}$$

In *f* c.c. of this gaseous mixture *g* c.c. of methane were found. Consequently the actual percentage of methane is

$$\frac{g}{f} \times \frac{A + p}{A}(A + q - e)$$

With regard to the magnitudes of the corrections for a gas of particular composition, they depend on the values of p and q. Consequently these values should be as low as possible.

The magnitude of the corrections may now be ascertained for ordinary coal gas. Let the following values be assumed:—

p	q	A	e	f	g
2	2	87	50	10	9 c.c.,

then the correction for percentage of hydrogen amounts to—

$$e\frac{p}{A} - \frac{p + q}{5} = \frac{100}{87} - \frac{4}{5} = 0{\cdot}3 \text{ c.c.}$$

Consequently, the omission of this correction would introduce an error of 0·3 per cent.

The correction for the percentage of methane would amount in this case to—

$$\frac{g}{f}\left\{\frac{A + p}{A}(A + q - e) - (A - e)\right\} = \frac{9}{10} \times 2{\cdot}9 = 2{\cdot}6 \text{ c.c.}$$

The omission of this correction, therefore, would introduce an error of 2·6 per cent.

With regard to the free space in the iodic anhydride pipette, it continues to increase slowly, owing to the reaction which takes place when the pipette is in use. Consequently, the free space should be re-determined from time to time.

A fair idea of the profitable nature of coal mining during the last two years or so can be gathered from the figures given with regard to the increased profits earned by a Northumbrian Company, which has just been converted into a limited liability concern. In 1898 it is said to have profited to the extent of £31,118; in 1899 the profits rose to £55,601; and for the current year they are at the rate of about £95,000.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting at Denver.

The Twenty-eighth Annual Meeting of this Association was held at Denver (Col.) on Oct. 17th, 18th, and 19th. Mr. G. G. RAMSDELL, of Philadelphia, the President for the year, occupied the chair; and there was a good attendance. The list of applications included 36 for active, and 12 for associate membership. M. Th. Vautier, the President of the International Gas Congress at Paris, and Dr. Auer von Welsbach were elected honorary members. The resignations during the year were 13.

The Committee on Research reported (see *ante*, pp. 1338, 1340) that during the past year they had undertaken experiments to determine a useful working standard for the measurement of the illuminating power of gas, and found that, with proper treatment, both the Harcourt 10-candle standard and the Edgerton chimney with the Sugg "D" Argand, were highly satisfactory. Some appendices to this statement were submitted at a later stage of the proceedings. The proper point for mixing coal and water gas was suggested as a suitable subject for investigation; and a hope was expressed that some member would take the matter in hand and report upon it at the next meeting. Some work had also been done on the measurement of high temperatures; but the experiments were not yet complete, though it was hoped they would be ready for the next meeting. Other questions before the Committee were: The removal of tar from water gas, the production and separation of cyanides, and the effect of regenerator furnaces and anti-dips on the yield of ammonia. The Trustees of the Gas Educational Fund submitted a satisfactory report, portions of which have already appeared in our pages (*ante*, p. 1281). The first section of 19 had completed their three years' course. A second section, comprising at present 42 members, and a third section, numbering 53, were in operation. The collection of information and statistics had been continued; and there were at present 94 subscribers to the fund.

The President's Inaugural Address has already been reproduced in these columns—see *ante*, p. 1087.

The reading of the appendix to the report of the Research Committee, dealing with the experiments they had undertaken "to determine a useful working standard for the measurement of the illuminating power of gas" (which was given in full in the "JOURNAL" for the 27th ult., pp. 1338-9), was followed by a brief discussion. Mr. E. C. Jones described a standard burner which he had devised for use in testing incandescent lamps, and which was arranged to consume acetylene. He said that the variation in duty caused by carelessness and want of skill in dealing with the mantles, was much more serious than that due to any degree of change in quality of the gas that would be likely to occur under ordinary circumstances. He also expressed surprise that variations to the extent of 1¾ inches of mercury in the barometer should have no appreciable effect on the illuminating power. Mr. A. C. Humphreys remarked on the change that was taking place in the profession, as regards their attitude towards the photometer, which was instanced by the experiments just reported. There was need, he thought, for further investigations of the same kind. Mr. A. S. Miller regarded the experiments as a remarkable showing for the standard candle, and as especially demonstrating its superiority as a standard. The demand for something better was really an endeavour to substitute perfect machines for imperfect men.

Mr. Barret's paper on "Inclined Retorts" (see *ante*, p. 1278) aroused much interest; and many questions were put to the author at its close. Mr. Egner referred at some length to the history of the question, and said that, while a considerable length of retort had been adopted by some of the English gas engineers, in Germany a shorter retort was favoured. He believed that the coal used should be dry. Mr. Forstall remarked that, whereas the general practice had been to develop water gas in America and coal gas in England, the tables were now turned, as the present meeting was studying inclined retorts, while the English were directing their attention to water gas. The special feature of the inclined system was that the force of gravity was utilized and turned to account; and this force was constant and reliable in action. Mr. Littlehales claimed that the original suggestion for inclined retorts came from Montreal, and said that he was associated with the very first attempt to apply it in practice.

Mr. Barret, in reply, said he was satisfied that since he had adopted inclined retorts the yield of tar was less; but he had not ascertained where the deficiency had gone to, nor did he intend to guess. He was not prepared to give figures. He had not observed any change as regards density of coke; nor had he found any difference in the average frequency of stopped pipes. The wages per man were unaltered; but the men were not pushed so hard as with the horizontal retorts. As to the best length of retort to adopt, this was entirely dependent upon the quality of the coal to be used. A ¾-inch screen would about represent the best standard to which the coal should be broken before use.

A description of the means adopted for the repair of a crack in a 36-inch outlet-pipe from a gasholder, contributed by Mr. W. N. Tolman, of Philadelphia, was read by the Secretary. The tank of the holder was of masonry, 36 feet deep, with the ground-water standing about 19 feet below the coping. It was found that all the joints in the horizontal run beneath the tank wall were leaking; and this line of pipe was 22 feet long, and had three joints—one lead joint at the drip-pot, and the other two flange joints without gaskets. This was stopped by caulking with cold lead from inside the pipe; two being successfully completed, and the third nearly so, when a small crack appeared on the top of the pipe about 2 inches away from, and parallel to, the joint, which was the middle one immediately under the walls. The pipe at this point was embedded in solid masonry. The crack was very small, and only about 4 inches long, when first discovered; but it gradually lengthened, until it extended half way round the pipe, meeting the joint at the ends, and being ⅛ inch wide at the centre. Large volumes of water leaked into the pipe; and constant pumping was necessary to keep it clear. The crack was first plugged, as far as possible, with soft pine wood; and a wrought-iron sleeve, 8 inches wide and 34¾ inches outside diameter, was placed inside the pipe, and centred so as to give an equal joint all round. Grooves were made, to hold the jointing material in place; and the joint was made up with 4 inches of tarred oakum, having 2 inches of lead on either side. The lead joints were made with single strips of cold metal. The work was completed in May last, and had proved a successful job up to the present time. The crack was caused by settlement of the vertical pipe outside the tank.

An interesting lecture was next delivered by Dr. E. G. Love, on "The Theory of the Incandescent Gas-Light." This was given in full in the "JOURNAL" for the 20th ult., p. 1277.

Mr. W. C. Morris, of Long Island City (N.Y.), contributed a paper on the "Removal of Tar from Water Gas," which was read by Mr. Alten S. Miller. The author confined himself to the consideration of the removal of tar particles that might be present in the gas after passing the relief holder. He remarked that Professor Jacobus had shown that steam condensed only on the surface of solids and liquids, and not in the shape of a fog in an atmosphere free from dust or floating particles. All actual condensation that was carried with the current was in the form of streams on the sides or bottom of the pipe. With regard to unpurified gas, scrubbers were designed to give surfaces for the condensation of the supersaturated vapours. The tar particles might therefore be removed by the use of baffle-plate arrangements, by a suitable absorbing material, or by centrifugal action. Experiments were tried with a box 6 feet long, and 3 in. by 4 in. section, containing 132 thin plates of iron, so arranged as to break up and change the direction of the current of gas as many times as possible. Gas was passed through at several speeds, and with the free edges of the plates vertical or horizontal. In the first case, the tar drained against the gas, and in the second from between the bottom plates. The efficiency of the scrubbing action was determined by passing the gas at the outlet through a glass tube packed with cotton wool. Passing various quantities of gas ranging from 240 up to 600 cubic feet per hour, tar showed at the outlet in a few seconds, but sooner when the plates were in the vertical position. A Pelouze and Audouin No. 2 condenser, tested under varying conditions of pressure, proved ineffective in removing every trace of tar. A scrubber 4 feet in diameter and 16 feet high was packed with wooden strips ¾ inch wide, spaced ¾ inch apart, and arranged so as to break joint, and tested at various velocities ranging from 200 to 800 cubic feet of gas per square foot of sectional area per hour; but in all cases tar passed in a few seconds. A 10-inch pipe 16 feet long was packed with spruce shavings; and gas was passed for 80 days without a trace of tar showing at the outlet—the back-pressure being 8 inches. The shavings were found to be black for a distance of 2 feet from the inlet, brown for 5 feet, and oily for the remaining 8 feet. A scrubber 6 inches in diameter and 5 feet high, containing two 18-inch layers of shavings, was tested with gas passed at the rate of 600 cubic feet per hour (equivalent to 3100 cubic feet per square foot), and passed 30,600 cubic feet of gas before showing a trace of tar at the outlet. The back-pressure at the conclusion of the experiment was 6½ inches. This gave a duty of 65,000 cubic feet of gas per bushel of shavings. When removed, the lower layer was black for 10 inches, and brown for the remainder; and the upper layer was only oiled. A 21-foot length of 6-inch pipe was packed with 20 feet of shavings, and 89,100 cubic feet of gas passed through it at the rate of 2140 feet per square foot per hour, and until the back-pressure had reached 14½ inches, without any trace of tar appearing at the outlet. The shavings, when removed, were only tarry for 2½ feet from the inlet. The loss of illuminating value of the gas, caused by passing through the shavings, was 2 to 2½ per cent. Assuming a gas velocity of 100 cubic feet per hour, it would be seen that the 5-foot scrubber would run for 24 days, and the 20-foot for 152 days, without changing; and this appeared sufficiently promising to warrant a practical trial. The first purifier of each set was therefore charged with two layers of spruce shavings, 2 feet to 3 feet thick. Some difficulty was found to arise from the gas blowing through in places; and this was prevented by placing boards between the two layers and over the top, so as to cause the gas to travel from one end to the other through the bottom layer, and to return through the top layer—travelling twice the entire length of the purifier before exit. This proved successful in removing all traces of tar; and a duty of 210,000 cubic feet of gas per bushel of shavings was obtained. The pressure necessary for a velocity of about 1700 cubic feet per square foot of area per hour was 13 inches. A special plant was then constructed, consisting of six cylinders

each 10 feet diameter by 30 feet high, and to contain four 6-foot layers of shavings supported on wooden grids. They could be filled from the top by machinery, and emptied when required through the bottom. The back-pressure for a velocity of 920 cubic feet per hour, after several months' use, was 5·2 inches; and the quantity of gas passed up to the last renewal was 570,000 cubic feet per bushel. The author understood that Mr. Knapp, of Omaha, had also used spruce shavings for this purpose in a scrubber 8 feet in diameter, in two layers each about 18 inches thick.

Discussion being invited, Mr. Knapp said that the author had omitted to mention that the shavings should be moistened with water before being used, as otherwise the heat of the gas caused them to swell. Excess of pressure, due to accumulation of tar, could easily be got rid of by turning exhaust steam into the inlet. This could be done several times without injury to the illuminating value of the gas, as he had proved by connecting a photometer in such a way that readings for gas, either from the inlet or outlet, could be obtained. Mr. Norris said that where the purifiers were large, a layer of shavings on the botton grid was sufficient, and that one supply of shavings would last over several ordinary changes of the purifiers. Mr. Young thought that it was better to use separate boxes for the shavings.

Mr. W. Frucaff, of Denver, read a paper on "Gas Advertising," which he said was first recognized as a factor for the growth and development of the gas business in Denver by the late Mr. G. T. Thompson, under whose direction a plan of campaign was marked out for the year 1899. The Company adopted the plan of selling gas-stoves at cost price, fixing free, and giving 5000 cubic feet of gas gratis with each stove; and these advantages were advertised in each issue of the four daily papers—using a large script print to catch the eye. Rough sketches and short pithy sentences were employed; the copy being changed every fortnight, and different in each paper. An excellent pamphlet, entitled "Denver ladies do some talking," and giving personal experience, illustrations of interiors of kitchens, and other information, was also issued. A demonstration of gas cooking was given at a free pure-food show. The services of the billposter were freely resorted to, large illustrations appearing on every hoarding throughout the city; and space was secured for advertisement on the delivery tickets of two large grocery houses, and on those of other tradesmen. A well-known cookery book was also distributed gratis. Not the least important feature was the establishment of agencies for the payment of bills in drug stores throughout the city. In 1900, newspaper advertising was abandoned, and a systematic house-to-house canvass inaugurated. To meet the needs of those who could not pay for a stove at once, a cheaper line of stove had been introduced, and could be had for monthly payments. The sale of stoves in 1900 was three times as many as in the previous year; but this was partly due to the work of 1899. The results of the advertising were highly satisfactory.

Mr. F. D. Moses opened the discussion by giving various details as to the sale of stoves. He wanted it to be distinctly understood that the object was to increase the sale of gas, and not to build up a stove trade. Mr. H. L. Doherty advocated spirited advertising and canvassing, and said that a common mistake was to be in too much of a hurry for returns. Mr. Littlehales, while admitting the advantage of every possible form of advertising, said that a house-to-house canvass was absolutely necessary, and should never be omitted. Mr. Jenkins was in favour of advertising, followed up by canvassing. The advertisement made the want, and the canvassing supplied the means of satisfying it. Mr. A. C. Humphreys advised that the best advertising talent should be employed; and Mr. Doty remarked that both advertising and cookery demonstrations were valuable means of educating the gas consumer. Captain White said that local conditions must be considered, and that the aid of women was imperative. After some further discussion, the President proposed that the Association should officially assist in the efforts now being made by other Gas Associations for the establishment of a National Advertising Bureau.

A paper on the use of cards for records and accounts, by Mr. W. C. Anderson, of Norristown (Pa.), was read by the Secretary. Cards were already used to some extent; but the author advocated their employment to a fuller degree, and in place of books. The system was economical, because the initial outlay for a filing cabinet was the only real expense connected with it. He first described a form for a record of mains, which could be readily filed in such a manner as to be available at a moment's notice. If a book was used for this purpose, there must either be a great deal of cross-indexing or a waste of space at one part and crowding at another. This also applied to meter records; and by using a special colour for each size of meter, the number of various sizes could be accurately ascertained at any time. For similar reasons, he also recommended eyeletted cards for use in forming a meter-index record or route book. A form exhibited showed monthly entries for two years. The cards could be rearranged from time to time as alterations in the district occurred, in a manner that was not practicable with a book. The card system could be substituted for the rental-ledger; and a form to correspond with the meter-record book was exhibited. An advantage in this connection was that, as soon as an account was paid, the card could be shifted to another compartment, and thus the accounts still owing could be ascertained at any time. One book-keeper could look after a much larger number of cards than of book accounts. A similar method could be advantageously applied to the sales of products or of fittings. Cards were especially suitable for the canvassers' department, as affording a record of possibilities for future business. To ensure the successful working of the card system, one person must be in charge of it. Or where the number of cards was too large to be properly cared for in this way, they could be divided into separate departments. The cards used for recording accounts should be numbered consecutively; and thus the loss or mislaying of a card could be easily detected. The user of the system would find increasing applications and possibilities for it.

Mr. Glass opened the discussion, and said that his Company had adopted the system very extensively. The chief want was a good subject-index card, suitable for recording matter appearing in the Gas Journals. Mr. Humphreys thought the use of cards was rather getting out of hand, and that legitimate use might lead to abuse. The great feature was the preservation of the individual numbers; and after a time the system might become so unwieldy as to cause more trouble than it saved. He also referred to the use of the card system as connected with auditing or with legal processes. Books must at times be produced in Court, and cards would scarcely be accepted as legal evidence. It would be difficult to prove they had not been tampered with. Mr. Lathrop said that, while cards were suitable for many purposes, they would not do as financial records, or as a substitute for the ledger. Mr. A. S. Miller thought that cards should not be depended upon as the sole record, either for meter-indices or for accounts. If used at all, there should also be a book record. The object of keeping accounts was to avoid the possibility of fraud; and an employee having access to cards, could very easily make a meter record agree with a "short" cash record. On the whole, he agreed with the previous speaker. Mr. W. Forstall believed in the use of cards for certain purposes, and described his system, with the aid of examples. Mr. A. E. Forstall was favourably impressed with the system; but each set of cards should be under the control of one person, who was held responsible for every entry. Mr. Doherty doubted whether the card system could be successfully adapted to the purpose of an index for current literature. Mr. Norris said that, for purposes of reference, the cards were as useful and handy as a book; but to insure accuracy, there must be no divided responsibility. One person only should have charge of them.

"A Blue Glass Pyrometer" was the subject of a short contribution by Mr. E. H. Earnshaw, of Philadelphia. The common use of blue glass to modify the intensity of light had led the author to consider whether it could not be adopted for measuring temperatures, by the principle of obscuration. If one observed the temperature of a furnace through a sight-hole, and held a piece of blue glass in front of his eye, the heat would appear less intense. A second piece of glass would still further reduce it; and by the use of a sufficient number of pieces of blue glass, the light would be entirely shut out. Supposing that each piece of glass was of the same shade and thickness, and it was found that ten thicknesses of glass would completely obscure the light, one had a No. 10 heat or temperature; if twenty pieces were required, a No. 20 temperature. He had designed a light hand apparatus, with an observing tube and discs of blue glass, so arranged that any quantity of pieces up to 26 could be used, and the number easily read off. The instrument, as it stood, was only comparative; but it could be readily standardized. The tint of the glass and number of discs had been specially devised to meet the requirements of water-gas manufacturers; but the same principle could be adapted to other purposes, and to any degree of visible temperature.

Mr. E. C. Jones, speaking on the paper, remarked that in 1893 the author prepared a communication for the New England Association of Gas Managers, on "Everyday Pyrometry," and then exhibited a set of glasses twenty in number that had been standardized to show various temperatures from 315° to 1750° C. At best, the blue glass was only a makeshift; and on account of individual error, each man must standardize his own pyrometer. One cause of error was the failure of the pupil of the eye to adapt itself to varying intensities of light. Coming direct from a brilliant light, one would get a reading that would require modification after the eye had had time to adjust itself. Mr. Norris said that, in ordinary practice, the surrounding light conditions had an effect, even on the same pair of eyes. Two more thicknesses of glass were required at night, with the same temperature, than in daylight. Mr. Strecker thought the reading would tend to vary with the personality of the operator, and there would be difficulties in standardizing the instrument; but it was very useful, notwithstanding these objections.

In the report of the Committee on the President's Address, it was stated that the incandescent gas-burner, the gas-engine, the prepayment meter, the inclined retort, and more energetic and liberal policies of management, were some of the means and assurances of the future prosperity of the industry. The election of Dr. Auer von Welsbach to hon. membership was heartily confirmed. With reference to the departure by some pipe manufacturers from the standard dimensions agreed on by the Association, the Secretary was instructed to write officially to these manufacturers urging adherence to the standard; and members of the Association were advised to insist on having all specials made in accordance therewith.

The last clause led to an animated debate, in the course of which it appeared that some of the members looked upon the

"departures" as improvements, and would therefore support them. A motion to appoint a Committee on "Standard Accounts for Gas Companies" was agreed to.

Mr. A. E. Forstall then read a paper on "Governmental Control of the Price of Gas," which has already appeared in our pages —see *ante*, p. 1211.

The Committee on Final Resolutions suggested votes of thanks to the Committee on "Transportation," in appreciation of their earnest and successful endeavours to secure train accommodation and favourable rates for members attending the meeting, to the Entertainment Committee, the Denver Gas and Electric Company, the officers of the Association, the readers of papers, and the local Press. These were unanimously agreed to.

EFFECT OF BENZENE AND OTHER HYDROCARBONS ON THE ILLUMINATING POWER OF INCANDESCENT COAL GAS.

In a recent number of the "Engineer" were given the results of some interesting experiments on the effect produced upon the duty of incandescent coal gas by alterations in the natural illuminating power of the gas itself, which have been published by Dr. Samtleben, of Bremen. The gas was consumed in an argand burner and with a Welsbach mantle, and it was examined photometrically before and after the addition of varying proportions of benzene vapour, ethylene, acetylene, and gasoline. The argand consumed 5·3 cubic feet per hour at a pressure of 0·4 inch; the incandescent burner consumed 3·5 cubic feet at 1·18 inches. The illuminating power is given in German standard candles in the following tables:—

I.—*Benzene Vapour.*

Per Cent. by Volume.	Candle Power in Argand.	Candle Power with Mantle.
Traces	8·3	80·0
1·18	18·0	82·5
1·36	20·2	85·0
1·78	21·6	89·0
1·95	22·7	91·0
2·38	24·6	97·0

II.—*Ethylene.*

Heavy Hydrocarbons + C_2H_4. Per Cent.	Candle Power in Argand.	Candle Power with Mantle.
3·8	18·0	85·0
5·4	18·5	89·5
7·6	19·0	93 0
10·0	19·5	95·0
12·6	20·2	96·0

III.—*Acetylene.*

Heavy Hydrocarbons + C_2H_2. Per Cent.	Cand'e Power in Argand.	Candle Power with Mantle.
4·0	18·0	87
4·4	19·0	89
5 8	22·0	92
7·7	24·5	95
8·8	30·0	102

IV.—*Gasoline.*

Grammes per 1·5 Hectolitres.	Candle Power in Argand.	Candle Power with Mantle.
—	18	87
7·0	21	91
10·5	22	94
15·0	23	96
20·0	24	98

Manurial Value of Sulphate of Ammonia.—According to the "Chemical Trade Journal," Professor Stutzer, of the Government Research Station at Königsberg, referring to sulphate of ammonia as an excellent nitrogenous fertilizer, says there is no reason why it should be discredited in the cultivation of tea, as it can be applied to this plant as well as to any other perennial —of course, not by itself, but with other manures supplying phosphoric acid and potash.

Water Supply in India.—At a meeting of the East India Association, held last Tuesday at their rooms in Victoria Street, with Lord Reay in the chair, Mr. William Sowerby brought forward a project for supplying water in India during times of drought on the partial or complete failure of the monsoon rains. Considerable quantities of water, he thought, could be obtained in almost every part of India by means of deep but inexpensive artesian tube-wells. The chief points to be considered in boring the wells were the nature of the strata and the likelihood of obtaining water; and the data could be ascertained by the examination of existing wells and by a proper hydro-geological survey of the various formations. Large supplies could also be secured by means of accumulating and compensating reservoirs constructed in the valleys of the great rivers, along which there were many low-lying recesses that, without very much labour and with moderate-sized dams, or bands, could be made to retain considerable quantities of water, to be used only when the monsoon failed. A tank holding 6½ million gallons of water—sufficient to supply 1000 people with 25 gallons a day each for 260 days—he estimated could be constructed for £605. Such tanks, combined with artesian wells, would greatly mitigate the sufferings of the people of India during failure of the monsoon rains, though these supplies would, of course, be insufficient for any extent of irrigation of the crops, which must be supplied by rain or by canals from extensive reservoirs.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Winter Meeting of the Association was held last Saturday, at the Geological Society's Rooms, Burlington House—the PRESIDENT (Mr. C. H. Priestley, Assoc.M.Inst.C.E., of Cardiff) in the chair. Among the members were a number of gentlemen connected with other Societies who were particularly interested in one of the subjects down for discussion.

The SECRETARY (Mr. Percy Griffith) having read the minutes of the meeting held in Cardiff in June last,

Messrs. W. Jones (Pontypridd) and J. W. Lewis (Farnham) were appointed Scrutineers of the ballot-lists for the election of officers, members, and associates.

REPORT OF THE WATER BOARDS COMMITTEE ON THE CONTROL OF WATER UNDERTAKINGS AND SOURCES OF SUPPLY.

The report (which will be published *in extenso* next week) dealt with the main question under seven heads; and those heads convey the conclusions of the Committee. They are: (1) The present system of control over undertakings for public water supply is unsatisfactory; (2) the existing powers for enforcing a proper water supply are inadequate; (3) the areas allotted to existing local authorities are altogether independent of the sources of water supply, and the trouble and expense of forming "united districts" and "joint water boards" are unnecessarily great; (4) the law relating to underground water is inequitable and a standing danger to many public water supplies; (5) the law relating to the pollution of water requires revision; (6) the provisions for preventing waste are insufficient; and (7) the collection and publication of official returns relating to existing undertakings is much to be desired. The Committee, however, made no suggestion as to steps being taken towards securing the remedying of these matters, excepting in regard to the last; and as to that they proposed that the Association should endeavour to organize the systematic collection of data relating to the following subjects: (1) The available supply obtainable from various sources; (2) general information concerning existing water-works; and (3) information regarding districts not adequately supplied with water.

The subject of the report (which is commented upon to-day in "Water and Sanitary Affairs") was discussed at great length; but, as will be seen when we publish a summary of the speeches, no one came into conflict with the Committee.

On the motion of the PRESIDENT, seconded by Mr. W. MATTHEWS (Southampton), it was agreed that the report of the Water Boards Committee be adopted, and that it be printed and circulated.

NEW OFFICE-BEARERS, MEMBERS, AND ASSOCIATES.

The Scrutineers reported that the following officers had been elected for the ensuing year:—

President: Mr. W. A. Richardson, of Birkenhead.

Vice-Presidents: Mr. Frederick Griffith, of Leicester; and Mr. R. H. Swindlehurst, of Bolton.

Ordinary Members of Council: Mr. F. J. Bancroft, of Hull; Mr. C. Sainty, of Windsor; Mr. E. A. B. Woodward, of Wolverhampton; Mr. W. Millhouse, of Scarborough; Mr. H. W. Pearson, of Bristol; Mr. E. Sandeman, of the Derwent Valley Water-Works; Mr. C. E. Jones, of Leyton; Mr. W. Terrey, of Sheffield; Mr. Hamlet Roberts, of Ipswich; Mr. C. Gilby, of Bath.

The following new members and associates were also elected:

Members: Mr. F. C. Cook, of Hinckley; Mr. R. H. Machell, of Dewsbury; Mr. R. E. Middleton, of London; Mr. W. H. Prescott, of Tottenham; Mr. J. Shaw, of Darwen; and Mr. G. M. Taylor, of London.

Associates: Mr. J. R. Anderson, of London; Mr. W. W. Coster, of Cape Town; Mr. H. W. B. Cotterill, of Sheffield; and Mr. Lewis Mitchell, of Bury.

THE PROTECTION OF UNDERGROUND WATER.

The foregoing business fully occupied the morning sitting; and in the afternoon the members heard an interesting communication by Mr. W. MATTHEWS on the "Protection of Underground Water." It was full of suggestive matter, formed a good supplement to the morning's debate, and supplied a cogent argument in favour of control and new legislation.

An excellent discussion followed, a report of which will appear with the paper in a future issue.

VOTES OF THANKS.

The thanks of the members were then tendered to Mr. Matthews for his paper, to the Council of the Geological Society for the use of their rooms, to the Scrutineers, and to the representatives of other Societies who had attended to take part in the discussion on the report of the Water Boards Committee.

PLACE OF NEXT MEETING.

On the invitation of the President-Elect, it was decided that the annual meeting should be held at Birkenhead in June next.

A VOTE OF SYMPATHY.

Mr. G. GREENSLADE (South Hants Water Company) observed that last month one of their members, Mr. J. C. Amos, passed away. He thought it fitting the Association should send a vote of sympathy to his relatives. He proposed that this be done.

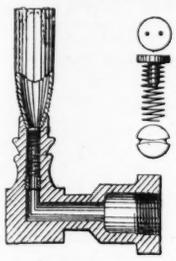
The PRESIDENT seconded the motion; remarking that he believed this was the first death they had had since the Association came into existence. It was a good precedent to record their sympathy with the relatives of their late friend.

REGISTER OF PATENTS.

Producing Coke, Gas, and Bye-Products.—Naef, P., of New York. Nos. 20,658, 20,659, and 20,660; Oct. 14, 1899. Date claimed under International Convention, March 14, 1899.

These are three of a series of patents taken out by the "inventor," whose proposals are sufficiently indicated in an article appearing elsewhere to-day, entitled "An Ambitious Inventor."

Regulators for Gas-Burners.—Wilson, J., of Plaistow, Essex. No. 23,088; Nov. 20, 1899.



The patentee's proposal is to insert in the space between the shoulder in the base of the burner and that formed by the elbow of the fitting, a spiral spring in tension, with a valve-plug upon each end, slotted or perforated so as to "allow exactly the requisite amount of gas to pass to produce the necessary illuminating effect." The shoulders formed by the joint and the base of the burner are the valve-seats, and since the slots or orifices are the only points of admission to the burner, the pressure of gas in the mains always tends to press the plugs against their seats.

Governors for High and Low Pressure Gas Supply.—Scott-Snell, C., of Saltash. No. 24,096; Dec. 4, 1899.

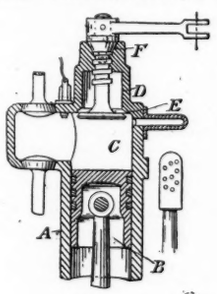
In explanation of his proposal, the patentee says that his invention has for its object to provide a burner which shall be effective for either high or low pressure of gas—that is to say, it is peculiarly suitable on gas-circuits in which gas is compressed and burned at a pressure above the normal which obtains in the street-main, or under equivalent conditions. In many installations, the gas is compressed by machines operated by water pressure, hot-air engines, or like sources of power. The failure of the source of power, however, leaves the gas at the normal street pressure, if an automatic bye-pass be allowed to come into action. The light at the burners is then very small, by reason of the necessarily small gas-apertures in the nipples designed to suit the heavier pressure.

In the present invention, a series of holes is provided, collectively large enough to maintain an effective light to the mantle, at normal gas pressure. The central hole is, however, of larger bore than the others; and when closed, it leaves sufficient aperture area in the remaining holes to provide the required illumination, while the machine is running and maintaining the gas pressure. A disc, ball, or diaphragm form of valve is formed, whereby, at a pre-arranged point in the gas pressure, it closes the exit of the low-pressure aperture, leaving the maintenance of the light entirely to the remaining high-pressure apertures. Governors, of course, exist for maintaining more or less steady issuing pressure to the gas; but in this invention the low-pressure aperture (not wire drawn) may be entirely cut off or the gas flow choked. It is evident, moreover, that the definite change in the burner, from its high-pressure function to its adaptability to low-pressure, is quite a feature compared with governing in the sense usually understood; and although the patentee says he prefers to absolutely cut off the low-pressure aperture, it is within the spirit of the invention to make the valve only partially cut off.

One form of the arrangement proposed to effect the object aimed at was described and illustrated in the "JOURNAL" last week, p. 1398.

Gas-Engines.—Hautier, C., of Paris. No. 1235; Jan. 19, 1900.

The object of this invention is to provide means for increasing or diminishing the area of the explosion-chamber, and providing a relief outlet therefor, whereby the starting of the motor will be facilitated by increasing the capacity of the explosion-chamber, "thus reducing the force of the explosion and at the same time permit a certain portion of pressure due to the exploding gases to escape into the atmosphere," and, after the motor is in motion, to reduce the capacity of the explosion-chamber, and at the same time confine the entire force of the pressure due to the explosion to the piston—it, of course, being understood that the charge of explosive mixture which is admitted to the explosion-chamber is constant at all times.



The illustration shows a longitudinal section of one end of a gas-engine, with the improved explosion-chamber; also a top plan view of same.

A is the upper end of the cylinder; B, the piston; C, the main explosion-chamber; and D, the auxiliary chamber, which is formed with a valve-seat E, opening into the explosion-chamber, and with a smaller valve-seat F, opening into the atmosphere. The valve-stem has a threaded engagement with the neck of the auxiliary explosion-chamber; and its lower end terminates in a conical faced valve, adapted to close against the seat E, and cut off communication between the main and the auxiliary explosion-chamber. This threaded valve-stem also carries an outwardly opening valve, adapted to close against the seat F; and on the projecting end of the stem is mounted a crank-arm, by means of which the stem and valves are simultaneously operated.

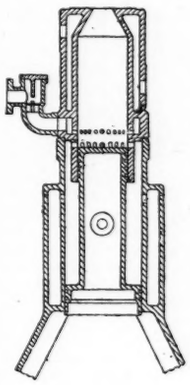
Liquid-Meters.—Frost, H. H., of Ardwick, Manchester. No. 15,892; Sept. 7, 1900.

This invention relates to liquid-meters such as are described in Patents No. 2720 of 1883 and No. 2578 of 1887; the chief object of the present improvements being to dispense with the packing and stuffing-box hitherto employed around the piston-rod, "whereby friction is diminished, and the meter is made more sensitive and reliable, and will measure the liquid accurately even when passed in very small quantities."

The claims made for the proposed new arrangement are: (1) In a liquid-meter having a measuring-chamber and a double-acting piston, dispensing with the ordinary stuffing-box and packing for the piston-rod, and, instead, surrounding it with a casing the only outlet from which is sealed by an extension of the sliding-valve cover. (2) In combination, a measuring-cylinder, double-acting piston, slotted piston-rod, casing surrounding piston-rod, valve-mover, projecting through a slot in the casing into the slot of the piston-rod, and an extension of the sliding-valve cover by which the slot in the casing is sealed. (3) The combination with the sliding-valve cover of an elastic ball bearing for the cover, by which slide-ways for it are dispensed with.

Internal Combustion Engines.—Bever, A., of Dewsbury. No. 9624; May 25, 1900.

This invention refers to the class of gas-engines which have two tandem pistons of unequal size—the smaller acting as the power piston, and the larger as an air-pump, and creating a partial vacuum in a reservoir so as to draw the waste gases out of the working cylinder, and draw in a fresh charge.

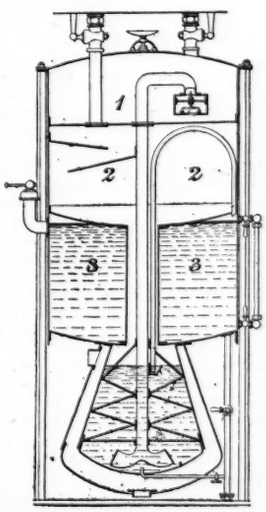


The explosion-cylinder is connected with the air-pump cylinder, by direct port-holes through the body of the cylinder. This connection is always open, and allows the waste gases to pass over, when the piston, in completing its outstroke, uncovers the exhaust-ports. The cylinders are fitted with a self-acting lifting exhaust, or a check-valve, which allows the waste gases to leave the air-pump cylinder during the return stroke.

The cycle of operations is as follows: If it is assumed that the pistons are at the back-ends of the cylinders, the working piston receives its mixture of gas or vapour and air, and compresses it. It is then fired by an ignition-tube or other device, and drives the piston outwards. In the meantime, it expands almost down to atmospheric pressure. At the end of its stroke, the working piston uncovers the exhaust-port, as shown in the engraving. The air-piston, during the outstroke, has created a partial vacuum; and when the working piston uncovers the exhaust-port, the interior of the working cylinder is put in free communication with the air-pump cylinder through the holes or ports in the cylinder. The partial vacuum then withdraws the waste gases, and also draws in a fresh charge of gas or vapour and air, which are compressed on the return stroke. The larger piston at the same time drives out the waste-gases through the check-valve; and the engine is ready for another explosion and working stroke.

Production of Carburetted Air by the "Cold Process."—Lothammer, F. J., of Paris. No. 15,930; Sept. 7, 1900.

Previous mention of the patentee's name in the columns of the "JOURNAL" will cause readers to take some interest in the present "invention," which is said to relate to "an improved apparatus for the cold production of carburetted air, which may be employed either as a luminant or for heating purposes, or as a motive fluid." The carburetted air is formed by passing air through liquid hydrocarbons—such as petroleum, benzine, or other similar liquid—in such a manner that the air, "by its mechanical work and its considerable subdivisions," is caused to be intimately mixed with the vapours of the hydrocarbons, thereby forming "a gaseous combustible fluid of absolutely homogeneous composition." The pressure is controlled from the commencement of the operation, and remains "absolutely uniform whatever the consumption"—that is to say, "production is in exact proportion to the consumption, and there is no possibility of over-production."



The apparatus comprises a cylinder, supported by legs, beneath which is arranged exteriorly a conical receiver C, which forms the real carburettor. The cylinder above is divided into three chambers, 1, 2, and 3. The chamber 1 is the pure-air chamber, in which the pressure is regulated by a weighted valve; and the air flows from this chamber by means of a central pipe F into the carburettor. The compartment 2 is the carburetted-air chamber, which is in connection with the carburettor by means of a large central pipe, and with the consuming apparatus by the pipe on the left of the compartment 1. The compartment 3 is the hydrocarbon reservoir, whose lower part is in connection with the lower part of the carburettor by means of pipes, and whose upper part is in connection with the upper part of the carburettor by a bent tube, which ensures the level of the liquid in the carburettor remaining constant. The actual carburettor is formed by a conical receiver, in which the level is maintained constant, and the compressed air which has to be treated flows through to the bottom of the receiver (the base area being larger than the area of the top), across metal gauze or perforated plates; and the air afterwards meets in the liquid. Plates of similar construction, inclined in all directions, are in combination with a heated air jacket surrounding the hydrocarbon receiver, so as to compensate for the cold produced by the evaporation of the hydrocarbon.

Regenerative Gas-Lamp.—Welch, W. H. I., of Bow. No. 16,626; Sept. 18, 1900.

This invention relates to overhead regenerative gas-lamps of the kind described in patent No. 8318 of 1895; the object being to so arrange the passages for the entering air as to simplify the construction and to reduce the risk of explosions when lighting the lamp. The passages for the entering air and for the issuing products of combustion are formed in a casting provided with a series of tubes arranged around the central chimney above the flame. Through these tubes the entering air passes, and is delivered on to the upper surface of an annular cone, where it is

Fig.1.

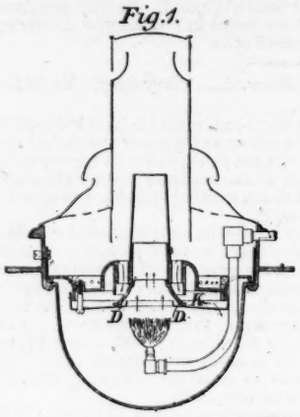
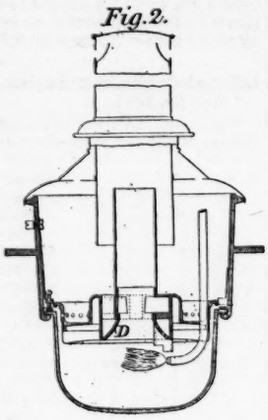
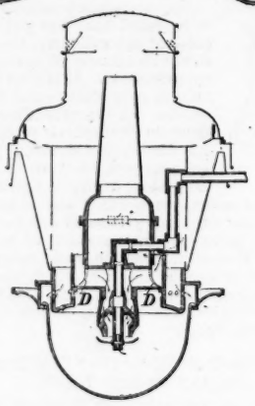


Fig.2.





highly heated; thence it flows through holes arranged to impinge on to the flame, while the products of combustion pass up a central chimney.

When the flame is vertical, as in fig. 1, the casting is supported on lips at the outer casing of the lamp, and is provided with a set of circularly-arranged tubes C directing the air over an annular cone D into a chamber K, the bottom of which is formed as an enamelled reflector provided with openings for the passage of the highly-heated air through the tubes C and over the annular cone. A portion of air, not so heated, is allowed to pass into the globe by small openings arranged around the casting. The chimney being quite open, there is free access for lighting the lamp, as well as for the products of combustion.

When the flame is horizontal, as in fig. 2, the chamber K is dispensed with, and part of the annular cone D immediately above the flame is made with perforations. This perforated part is surrounded by a casing open at the bottom, so as to direct the heated air on to the upper part of the horizontal flame. The rest of the air necessary for the combustion of the gas is supplied to the globe through small openings, as in the former case.

When the flame is circular, as in fig. 3, the tubes C and the annular cone D are connected by channels to a central chamber immediately above the burner; free passage to the chimney being left on each side of the channel. The air for supporting the combustion of the flame passes down the tubes C impinging upon the upper surfaces of the cone D, thence through the passages to the central chamber, and thence in a highly-heated condition through holes to the upper part of the flame from the burner. The air for the underside of the flame is supplied to the globe through small openings, as in the former cases.

APPLICATIONS FOR LETTERS PATENT.

21,347.—Miller, H. W., and Graham, M., "Measuring and delivering coal to furnaces." Nov. 26.

21,387.—Kitson, A., "Protection of incandescent mantles." Nov. 26.

21,390-1-2-3.—Sargent, C. E., "Internal combustion engines." Nov. 26.

21,394.—Craig, J. A. I., "Coin-controlled meters." Nov. 26.

21,414.—Walker, J. H., "Gas-cooker." Nov. 27.

21,465.—Simmance, J. F., and Abady, J., "Water-heating apparatus." Nov. 27.

21,476.—Skinner, G. H., "Gas and similar engines." Nov. 27.

21,511.—Rauthmell, T., "Generating acetylene gas." Nov. 28.

21,518-9.—Purves, W. T., and the Notkin Syndicate, Ltd., "Automatic carburetting apparatus." Nov. 28.

21,588.—Cox, J. H., "Combining acetylene gas with air." Nov. 29.

21,622.—Boult, A. J., "Supplying air or other combustion supporter to gas or other burners." A communication from the New Process Lighting Company. Nov. 29.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Oil and Carburetted Water Gas.

Sir,—However widely I have been compelled to differ from your opinion on a technical question of which I have intimate knowledge, I most highly esteem your courtesy and skill in dialectics.

To your final remark, that "there are no means of ascertaining the extent of this relief" from 5½d. (?) in the price of oil, I oppose the statement in my previous letter—viz., "At the present moment, future supplies of the best quality of gas-oil can be booked at less than 3½d. per gallon." While not advising immediate purchase, I will undertake that any of my friends now requiring oil shall obtain cargoes on such terms.

9, *Victoria Street, S.W., Dec.* 7, 1900. A. G. Glasgow.

The Sale of Stock to Gas Consumers.

Sir,—In my letter of last week, on the sale of stock to gas consumers, there is a slip of the pen which makes one of the most important sentences unintelligible. The sentence reads: "But when tendering many do not understand." Omit the word "when," and the point I wished to make becomes clear.

Your contemporary, "Fairplay" of Nov. 29, p. 898, says, on this subject: "The general run of investors do not understand tendering; and if they want the bonds [the proposed new issue of Exchequer Bonds] will have to get them later on from the professional 'middleman,' and give him his profit. . . . The fixed price system would afford the small investor a chance of getting in on the 'ground floor,' and square with the desire that he should have a fair chance, expressed by Sir Michael Hicks Beach when the National War Loan was brought out last year." It may, in fact, be said that the sale of gas stock by auction or tender is not the best method to ensure the placing of the stock at a good price. The *clientèle* of a sale by auction is very limited. There may be fifty in the room; but probably not more than half are buyers, and of these a certain proportion are the middlemen referred to in "Fairplay." Sale by tender is not much better. The issue of stock is not brought to the notice of buyers in a way to attract their attention, or that they can understand; whereas the direct offer to the consumers at a fixed price in quantities to suit all classes—and especially the investor of small savings—appeals to a very large number and never fails.

Dec. 8, 1900. George Livesey.

Piping Gas to London from the Pit's Mouth.

Sir,—The "Journal" for Jan. 19, 1869, contained a letter from me to its then Editor, calling attention to a paragraph which had just appeared in an illustrated periodical, setting forth the advantages of making gas at the pit's mouth, and piping it up to London. The following is practically the whole of the paragraph in question:—

The Metropolitan Board of Works has again had the question of the removal of gas manufactories from the populous districts of the Metropolis brought under its consideration. The proposal for a remedy to the present dangerous and preposterous system of making gas in the most crowded parts of the richest city in the world is limited to removing the factories into the country, and conveying the product by a few miles of piping to the consumer. We really cannot understand why our gas should not be made at the mouths of the coal-pits that supply the material, which by a costly and tedious process is at present brought to London by rail or sea, the freight being not less, probably, than 10s. per ton between the pits and the factories, all of which the consumer pays, besides being injured in health and endangered in person by means of the manufacture taking place in that which is the worst possible spot in the world for the purpose. The cost of laying down gas-mains between London and, say, Newcastle, would not be greater than the maintenance for a short period of the fleet of colliers which bears the crude material to London, where wages, living, and land are more costly than anywhere else. As to the removal of the gas factories out of London, that is, of course, merely a question of time and convenience.

I do not propose to discuss the merits of the project set forth in the preceding paragraph, but merely bring it forward in connection with a similar one described as "novel" in yesterday's "Daily Mail." I give below the entire article:—

To make London a clean and smokeless city is the dream of the ardent smoke abatement reformer. Mr. E. Baynes Badcock, who has devoted some years to the study of the question, has a scheme for the disappearance of London's smoke which is novel, if not convincing. Just as there are enthusiastic persons who conceive that sea water may be brought to London through the medium of iron pipes, so Mr. Badcock believes that gas can be made at the pit's mouth, and conveyed to London through pipes, and that instead of using coal, the thrifty householder would be disposed to have gas and coke fires, thus preventing any smoke. "The nearest coalfields to London," said Mr. Badcock to a "Daily Mail" representative, "are in the neighbourhood of Coventry and Leamington. I should erect a gas plant on that coalfield, and thence I would run a cast-iron main gas-pipe to Brentford, or elsewhere near London where gas-works abound. I would use those gas-works as storage and distributing systems for the gas brought from the coalfields. By that means the capital outlay of the gas companies would be preserved. The main to London could be laid from the coalfields for the greater part of the distance above ground; thus reducing the cost of the undertaking. I should say that 2½ millions would cover the whole cost of laying the pipes. The enormously reduced cost of the gas would repay that expenditure in a short time. People would find that a coke and gas fire was so infinitely less expensive than a coal-fire, that economic laws, in the natural course of events, would enforce that method of heating and cooking. And then good-bye to your smoke nuisance!"

I leave this so-called "novel scheme for making London smokeless" to the consideration of your readers.

London, Dec. 8, 1900. Lumen.

The Valuation of Gas Liquor.

Sir,—Some explanation seems necessary in connection with the description of the method of testing ammoniacal liquor by the Bristol Gas Company, and the illustration accompanying it, on p. 1397 of your last issue.

The funnel with the glass stop-cock having been done away with in

the apparatus, it will be obvious that the 20 c.c. of strong soda solution must be introduced into the flask C with expedition, and the stopper carrying the bulb and eduction tube should be immediately put on, so as to prevent any loss of ammonia. It may also be mentioned that at the end of the process of distillation, to prevent any syphoning back of the test acid from the flask D (*which would have been obviated by opening the glass stop-cock*), in the apparatus as illustrated will have to be done by taking out the stopper with the bulb from the flask C.

These points are obvious enough to those who are acquainted with the process, but might be puzzling to a beginner trying to follow the instructions so lucidly given in the Bristol Gas Company's statement, which you have reproduced.

F. J. R. CARULLA.

Derby, Dec. 5, 1900.

On the same subject, Mr. JOHN PHILLIPS, Secretary of the Bristol Gas Company, writes: When we first used the apparatus, we had a funnel with a glass stop-cock; but we found that this weakened the stopper, and also gave rise to slight error, owing to the accumulation of ammonia in the tube. As our Chemists are all experienced men, we have now discontinued its use. The cork must, of course, be replaced immediately the soda solution is introduced. The syphoning back is easily prevented by removing the cork from the distilling flask C, or the tube from the acid flask D, before turning out the gas.

LEGAL INTELLIGENCE.

COURT OF SESSION—SECOND DIVISION.

Tuesday, Dec. 4.

(*Before Lord* STORMONTH DARLING.)

The Perth Corporation and their Gas-Works Contractors.

To-day the record was closed in an action brought by the Lord Provost, Magistrates, and Town Council of Perth against Hugh Symington and Sons, Contractors, of Coatbridge, to recover £1104 13s. 6d. as the amount of over-payments made and expenses paid by the pursuers in connection with the contract by the defenders for the execution of works on the site of the proposed new gas-works at Friarton, near Perth. There was also a claim for £1000 as damages for breach of contract.

The pursuers say that, during the progress of the works, alterations were made upon the written authority of their Engineer, and the defenders were paid certain sums. On May 17, 1898, they sent a schedule of measurements of work alleged to have been done by them, making a total value of £6176, and a statement showing the balance due to them as £1376. The pursuers instructed their Architect to examine and measure the work, and he did so, as far as he could. But a large part of the work had been covered up; and he found it impossible to examine or measure that. He met one of the defenders, and received from him statements, upon which he relied, regarding the extent and quality of the work; and he adjusted the account at £5817 14s. 7d. On the 8th of December pursuers paid the balance alleged to be due. Then it is said that in November, 1899, the pursuers were informed that one of the retaining walls which had been built by the defenders for the erection of the new gas-works was not in accordance with the specifications, and utterly unsuited for the purpose. They say that, on examination, an overstatement of work done was discovered to the extent of £604 13s. They claim this, and also £500 for opening up, repairing, and strengthening walls and buttresses. They say they have suffered serious loss, damage, and inconvenience in consequence of the delay in the erection of the new works, and that they anticipate further loss.

The defence is that the defenders have not received payment for work which, in their knowledge, was unexecuted; that they have not induced the pursuers to make payment of sums not justly due; that the pursuers have not incurred any expense in respect of misrepresentations by the defenders; and that the pursuers and their Engineer accepted the work, and there was a concluded settlement between the parties. The defenders deny that any portion of the work was so covered up that the Architect could not examine and measure it. They deny that one of them gave any particulars, and say the account was adjusted at £5817 without interference on their part, except that, for an amicable settlement, they agreed to abate from the sum claimed £359 4s. 8d., which they considered they were entitled to in respect of certain deviations from the original design ordered by the Engineer, and that they abstained from putting forward claims which they considered justly due for other deviations. They reserve their claim for the £359 4s. 8d., and the cost of other deviations. As to the retaining wall, they say it was built according to a modification, and was perfectly suited for its object. The pursuers, however, have used the wall for other purposes than as a retaining wall, and have erected a building up against it, the roof of which rests upon the wall.

The case was sent to the procedure roll.

LIVERPOOL ASSIZES—NISI PRIUS COURT.

Friday, Dec. 7.

(*Before Mr. Justice* BUCKNILL, *and a Special Jury.*)

The Liability for the St. Helens Explosion.

This was an action brought by the St. Helens Corporation to recover £5000 damages from the United Alkali Company, Limited, for injury done to the gas-works of the plaintiffs by the explosion of some chlorate of potash on the defendants' works on the 12th of May, 1899.* The defendants denied that they, in fact, manufactured and stored potash; but, in the alternative, they said chlorate of potash was not a dangerous substance, and they were not guilty of negligence in the way in which they carried on their business.

Mr. DANCKWERTS, Q.C., Mr. CLARKE HALL, Mr. HUTCHINSON, and Mr. RIGBY SWIFT appeared for the plaintiffs; Mr. JOSEPH WALTON, Q.C., and Mr. HORRIDGE represented the defendants.

*See "JOURNAL," Vol. LXXIII., pp. 1311, 1365.

Mr. DANCKWERTS, in opening the case, said the action was brought to recover damages for the destruction of part of the plaintiffs' property in consequence of an explosion of chlorate of potash upon the defendants' premises on the 12th of May last year. The Jury would see, from a series of plans which had been prepared, that the defendants' works were located round about Warrington New Road, St. Helens, and that on the other side of the road were situated the gas-works of the Corporation. In those works there were two gasholders and a number of buildings of various kinds. The plans showed the several areas in which total and partial destruction of property occurred; and it would be seen that the explosion which was caused was of an exceedingly violent character, and such as to create wreck and ruin in the neighbourhood. Some unfortunate people also lost their lives. The learned Counsel proceeded to describe by the aid of the plans the position of the portion of the defendants' works in which the explosion took place, and the operations carried on therein. On the day the explosion occurred, 99 wooden casks had been received from Messrs. Bryant and May, in whose business, he understood, chlorate of potash was largely used. They had been sent to the firm filled with chlorate, and were subsequently returned empty. After being examined at the cooperage, they were brought to the chlorate-house. A man was engaged in rolling the casks into the house when, owing to one slipping, a spark was given off which fell on the woodwork of one of the crystallizing tanks, and it at once burst into flame. No possible cause could be assigned for the spark save that the casks had been splashed with the composition used in making matches. The fire extended, and in less than ten minutes the explosion occurred. It was of a most violent character, and its force was expended in the direction of the gas-works. One of the holders, which was about three-quarters full, and had risen to a height of 60 feet, was torn asunder, and a great volume of gas escaped, which ignited, and a column of flame rose into the air some 500 or 600 feet. The second holder was seriously damaged; and in making the works good the Corporation had been put to an expense of about £4000. The Jury, however, would not be troubled with figures, because he was informed that the Solicitors on either side had come to an understanding upon the point, and the Jury would only have to concern themselves with the question of liability. How the explosion was caused was, of course, more or less a matter of speculation, because no one actually saw it; but he thought the Jury could be easily satisfied upon the point. As to the alleged liability of the defendants, there was a doctrine of the law of England to the effect that people must so use their property as not to injure their neighbours; and it was upon this simple proposition that the plaintiffs relied. There was the further ground alleged that the defendants were negligent in the way in which they dealt with the chlorate. They were also negligent in having wood upon the premises where the material was made and stored; in having wooden surroundings to their vats and coolers; and in not taking precautions that the returned casks were thoroughly cleansed inside and out, so that there should be no trace of match-making composition upon them. Negligence was also alleged in the fact that all these operations were carried on under one roof.

The following witnesses were then called:—

Mr. *S. Glover*, Gas Engineer to the Corporation, deposed to seeing clouds of smoke emanating from the defendants' works. He went in that direction, and in a few minutes an explosion took place. He described the damage done to the gas-works.

William Bate, a cooper employed at the Kurtz works—the portion of the premises of the United Alkali Company where the explosion occurred—described, by means of models of casks, how he placed one cask on end against two others, and how it slipped. He said he saw the spark, and noticed it strike the cooler, which quickly broke into a flame. He gave an alarm of fire.

Dr. *Best*, Chemist and Manager for the Hardshaw Brook Chemical Works of the Company, said he went across to the Kurtz works when he saw the smoke. He looked inside the chlorate-house, and saw that the fire had got hold of the coolers, and was running from one to another. He made no attempt to save the building, as he thought the fire had gone too far. He and others ran away, and when they had reached a distance of about 50 yards the explosion occurred. This was about ten minutes after he first saw the smoke. He had never before known an explosion of chlorate of potash, which was not classed as an explosive; and he was prepared to stake his professional reputation upon the statement that, as a pure chemical, it would not explode under any circumstances whatever.

Saturday, Dec. 8.

Further evidence in support of the plaintiffs' case was given to-day.

Mr. *L. G. Boor*, a London merchant, said he had been connected for 28 years with the manufacture of chlorate of potash, and during that time had received casks from customers, who were principally match manufacturers. His experience had been that such casks when rubbed together had emitted sparks. He had not, however, known of an explosion of chlorate of potash by itself.

Mr. *Guttmann*, Consulting Engineer and Chemist, said he had had large experience in explosives. Chlorate of potash, which was a chemical compound, was not officially classed as an explosive, nor was it one of those with regard to the manufacture of which any special conditions of prohibition had been issued under Order in Council. It was an explosive, however, when mixed with any combustible or carbonaceous substance. The St. Helens was the first known case of an explosion of a chlorate store; and, in his opinion, it was perfectly foolish to have had so much as 150 tons under one roof.

Professor *G. Lunge*, who was formerly Manager of the Tyne Alkali Works, South Shields, and now Professor of Chemistry at Zurich, said, as the result of many years' experience in the manufacture of chlorate of potash, that until the St. Helens explosion it could not be called an explosive at all. The accident had to some extent opened the eyes of experts. He still thought they might put into a store any quantity of chlorate without danger. Asked if wood used in chlorate of potash coolers was the right material to employ, witness quoted from a book written by himself to show that wood lined with lead was the only thing then known. Questioned as to whether chlorate increased the inflammability of wood, he answered: "Most certainly;" adding that the less inflammable matter there was present, and the farther the processes of manufacture were separated from each other, the less was the danger.

Asked whether chlorate should have been regarded with suspicion on the ground of experience having taught people that many substances of an endothermic kind, believed to be non-explosive by themselves, had with further knowledge been discovered to be explosive, witness replied that some might have had a suspicion that chlorate by itself would explode. Had the tanks been of non-inflammable material when the sparks reached them, he did not think the explosion would have happened.

Mr. *T. A. Green* said that the result of many years' experience in the manufacture of chlorates led him to declare that all the processes should certainly not be carried on beneath one roof. Under his own management, the store was situated at a distance from the manufacturing processes, as otherwise there would have been danger. They introduced iron tanks from the beginning—never had wooden ones. The tempera ture in chlorates sometimes rushed up suddenly, causing the liberation of a great volume of gas. As a manufacturer, he regarded chlorate of potash as a substance to be carefully looked after.

The further hearing of the case was adjourned till yesterday morning.

Withdrawal of the Injunction in the Denbigh Steam-Roller Case.

Sir Horatio Lloyd, of the North Wales and Chester County Court district, has just intimated to the Registrar of the Denbigh County Court that the injunction which he granted against the use of a steam-roller by the Denbigh Corporation, at the instance of the Denbigh Gas and Water Companies (*ante*, p. 1407), would be withdrawn. His Honour stated that, after fortifying his memory by reading the report of the action (which was heard nearly three months ago), he found that the question of giving up the claim for injunction was undoubtedly mentioned; and he thought enough had been said to justify the defendants in supposing that it was abandoned by the plaintiffs. Under the circumstances, he withdrew that part of his judgment which directed the issue of an injunction. The award of damages in each case would, however, stand. The costs would be still on the B scale, as an injunction was claimed. As a result of the above decision, the Corporation have decided not to proceed with their intention to apply for a new trial, as it is believed that the question of any further damages to pipes by the steam-roller can be amicably settled between the parties on the basis of the Judge's finding on the question, having regard, of course, to the depth of the pipes, their quality, and the manner of laying.

Proposed Purchase of the Hartlepool Gas and Water Works.—At the monthly meeting of the West Hartlepool Town Council last Tuesday, resolutions were passed empowering the Corporation, in conjunction with the Corporation of Hartlepool, to promote, in the next session of Parliament, a Bill to authorize the purchase of the undertakings of the Hartlepool Gas and Water Company.

The London County Council and the Water Question.—At the meeting of the London County Council last Tuesday, it was unanimously agreed, on the recommendation of the Water Committee (*ante*, p. 1411), to ask the President of the Local Government Board to receive a deputation on the subject of the water supply of the County of London—the Water and Parliamentary Committees to form the deputation.

Gas Profits and Rates in Manchester.—Alderman Gibson's motion with regard to the disposal of gas profits, to which reference has already been made, was placed on the *agenda* for the usual monthly meeting of the Manchester City Council last Wednesday; but, as on three previous occasions, discussion on the matter had to be postponed. The question will accordingly be dealt with, unless there should be a further adjournment, at a meeting of the Council to be held next week.

Automatic Meters, Stoves, &c., in Leeds.—According to a report lately presented to the Gas Committee of the Leeds Corporation, during the year ending in March last there was an increase of 1391 automatic stoves, 1644 automatic meters, 45 gas engines, and 747 gas-stoves; the income from these sources being £10,708, as compared with £6508 in the preceding year. There was an augmentation to the extent of 4·09 per cent. in the amount of gas made, and of 3 71 per cent. in the quantity sold.

Tenby Water Supply.—The Water Committee of the Tenby Corporation have lately had before them the report of Mr. James Mansergh, respecting the water supply of the town. The document deals with the five proposals which have been made: (1) Filtration of the Ritee water, estimated to cost £13,500; but Mr. Mansergh does not regard this source as satisfactory. (2) Springs in St. Florence Valley, estimated to cost £20,500; but the yield is not sufficient for the town's need. (3) Boring for an underground supply, which is almost impossible. (4) The Tavernspite source, estimated to cost £50,000; but Mr. Mansergh does not approve. (5) Precelly Mountain, estimated to cost £67,000, which he regards as best for the town. To carry it out, he suggests that Tenby should join with neighbouring places. The Committee decided to print and circulate the report.

Water Supply of Teignmouth.—Another discussion on the subject of the water supply took place at the meeting of the Teignmouth District Council last week. The Water Committee were of opinion that a local source of supply which had been suggested was unsuitable, as it would necessitate pumping and the construction of a large reservoir. A deputation had had an interview with the Torquay Water Committee as to obtaining a supply from the town, but had not arranged terms. In the course of the discussion, the advantages of a local supply, as opposed to one from Dartmoor, was again urged by some of the members. Mr. Slocombe contended that this idea of getting a supply locally had been the great stumbling-block in the way of improving the service. It had always been brought forward to prevent the carrying out of any practical scheme; and the result was that they had spent thousands of pounds on temporary measures, and were still far from a solution of the question. There was not sufficient water in the district to give an abundant supply to the town. They might offer a premium for a gravitation scheme, or take some other practical step so that they might not go drifting on into next summer and have nothing done. Mr. Banbury thought that they required the services of an expert, and that it would be better to engage an engineer than to offer a premium. It was decided to hold a special meeting of the Council to consider the subject; and Mr. Banbury gave notice of his intention to move that Mr. Baldwin Latham be asked to advise the Council.

MISCELLANEOUS NEWS.

PRICE OF GAS IN NORTH LONDON.

A Protest from Penny-in-the-Slot Consumers in St. Luke's.

Under the auspices of the St. Luke's Peabody Buildings Gas Consumers' Protection League, which has for its patrons Mr. H. C. Richards, Q.C., M.P., and Mr. J. Allen Baker, a crowded meeting was held in the Memorial Hall, Roscoe Street, Bunhill Fields, on Friday, the 30th ult., "to protest against the heavy charges made for the use of gas and fittings by the Gaslight and Coke Company to the residents of Peabody Buildings, St. Luke's." Mr. Alderman Pond, a member of the New Finsbury Borough Council, presided.

The Chairman, in opening the proceedings, gave a brief history of the League, and said they meant business in fighting the Gaslight and Coke Company.

Mr. E. Howes (Mayor of Finsbury) said that, though they had met to consider the "penny-in-the-slot" grievance, the whole question of the price of gas was bound up with it; and they meant to keep on knocking at the door of the House of Commons until they obtained a remedy. They did not wish to confiscate the property of the Gaslight and Coke Company. If the Company had chosen to waste their money in the past, they could not expect the consumers of this generation to pay. Let the shareholders take the burden. He was pleased to say that the City of London had woke up at last, and only on the previous day the Common Council had agreed to act with the London County Council in this matter; so that when the Company came before Parliament for financial aid, they would take the opportunity of making themselves heard. If it had not been for the united action of the Corporation and the County Council last session, £36,000 would have been lost to the London Local Authorities on the public lighting north of the Thames.

Mr. H. C. Richards said the movement had his greatest sympathy; and, as one of the representatives in Parliament for the district, he would use his best endeavours in helping the residents. What they must do was to get the large consumers to join them in the fight. If the 28 new Borough Councils would fall into line with the Corporation of London, they would be successful in bringing the Gas Company to book. It was only the unanimity of the Vestries that saved the situation last year. With regard to the hardship of paying so high a price for the gas supplied through the automatic meters and fittings, he would confer with his friend Mr. Walter Long (the new President of the Local Government Board), who was one of the Trustees of the Peabody Buildings, and see if he could not get him to influence the Trustees of the estate to purchase the fittings from the Company. If they could get no remedy from the Company, they would have to bring pressure to bear upon the new Borough Councils to obtain Electric Lighting Orders, and thus have the Model Dwellings lighted up by municipal electricity. In the meantime, they must keep on knocking at the door of the House of Commons. If a Committee of both Houses were formed to go into this matter, he should be pleased to give evidence, and would call the tenants of the Model Dwellings to do the same.

The Chairman then read a letter from Sir Albert Rollit, who was unable to attend the meeting, expressing sympathy with the movement. He next read the resolution of the tenants not to use penny-in-the-slot meters in their rooms until the price of gas was reduced (see *ante*, p. 1154). This resolution, he said, was signed by 400 of the tenants in 24 hours—this being the only time available—and sent to the Gas Company, who, in reply, simply said: "This Company has no power to charge any consumers preferential rates for the supply of gas, and only a uniform rate for fittings." Thus the question was burked. The tenants did not ask for preferential rates, but for a reduction in the price of gas and fittings all round on the line of the South Metropolitan Gas Company. The Gaslight and Coke Company must be reminded of their promise, and the inducement they held out to the tenants of the Model Dwellings to take the automatic meters and fittings. They were told that it would only cost 1d. to 1½d. to cook a Sunday's dinner; whereas actual practice showed that it cost anything between 3d. and 4½d.

Mr. J. Rowlands moved the first resolution—"That this meeting of gas consumers emphatically protests against the exorbitant charges by the Gaslight and Coke Company for gas and fittings, and urges upon the Government the necessity of legislation to protect the interests of small gas consumers north of the Thames." He said he thought it would be only waste of time to complain to the Company; but he would like its Chairman to be present to see the magnificent protest that was being made, and then think how it would fit in with his speech at the last half-yearly meeting of the Company, when he said: "I am glad to be able to say that, though we have some 360,000 consumers or thereabouts whom we supply with gas, we have received protests against the rise from a quite insignificant number of those consumers, and the complaints have been confined to some few people who appear to expect the price of the quartern loaf to remain the same whether wheat stands at 28s. or 40s. a quarter." Why, he would ask, did not Colonel Makins get a large number of complaints from consumers as to the high price charged by his Company for gas? Because the only answer they would get would be to this effect: "We acknowledge receipt of your protest, and are very sorry; but please pay up." With regard to the Colonel's remarks about the people who always expected the quartern loaf to be at the same price, he (the speaker) was not one of them; but he did not expect that, with flour at a given price all over London, a baker on the north side of the river would charge nearly 50 per cent. more for a loaf than one on the south side. This was how the question of the price of gas now stood. Colonel Makins was very fond of bringing in his (the speaker's) name at the half-yearly meetings of his Company. One year Colonel Makins sent him a most elaborate set of figures, and then, because he (Mr. Rowlands) did not reply, he told his meeting that he (the speaker) could not answer them. Not being a gas expert, he did not give any attention to the figures; and when he found that the "Journal of Gas Lighting" was criticizing them very strongly, he did not think it necessary to take the matter up. He did, however, know this—that every penny difference in the prices of the two Companies represented on the output of the Gaslight and Coke Company a sum of £80,000, and at the present difference

it was very nearly £800,000 per annum that the north-side consumers had to pay which they would save if the price were the same as that of the South Metropolitan Company. Mr. Livesey said it was "incompetence;" and if that was so, it was time an end was put to it.

Mr. J. A. Baker seconded the motion. He said he was a large employer of labour, and had a gas bill of about £800 per annum; yet at times he could not get enough gas to work his engines, and had to keep 80 or 100 men idle. As they were engineers who commanded good wages, they had a fair claim to be heard on this question. His gas bill came to about £250 more per annum than if his works were situated on the south side of the Thames.

The motion was carried unanimously.

Mr. J. Benson then moved—"That a copy of the foregoing resolution be sent to the Prime Minister, the Leader of the House of Commons, the President of the Board of Trade, the Town Clerk of the City of London, the Town Clerk of Finsbury, and to Mr. H. C. Richards, M.P.; and that he be asked to take the necessary action in the House of Commons to secure a reduction in the prices of gas and fittings." He said the Gaslight and Coke Company stood before Parliament as a mismanaged undertaking. The Company stated that the principal reason for the increased price now being charged for gas was the enhanced cost of coal; but they ignored the fact that the high price received by them for residuals nearly balanced the extra amount they were paying for coal. The Company had not carried out their part of their original agreement, which stated that they were to carry on their undertaking with "due care and economy;" and it was a question that affected, not only the dwellers in the Peabody Buildings of the Metropolis, but in the whole of London.

The motion was carried unanimously.

A vote of thanks to the Chairman was proposed by a member of the Executive of the Gas Workers' Union. In doing so, he said they were watching the Gaslight and Coke Company, and had just received a letter from Colonel Makins telling them that he did not see his way clear to granting an increase of pay. However, they were waiting their time. They were 5000 strong, and were united. With regard to the question they had been considering, it had been proved that, instead of costing 1½d. to bake their Sunday's dinner, as promised when they adopted "slot" meters, it was costing them 4½d.; and therefore his advice to them was to take their dinner to the baker, who would cook it for 2d., and save them all trouble.

The motion was carried, and the proceedings closed.

SINGAPORE MUNICIPALITY AND THE GAS-WORKS.

Mr. Corbet Woodall's Report.

Our readers are aware that Mr. Corbet Woodall has recently returned from Singapore, where he has been advising the Municipality as to the purchase by them of the undertaking of the Gas Company. Copies of Singapore papers just to hand give the principal portions of the report he has presented on the subject.

Mr. Woodall is of opinion that, both for financial and practical reasons, it will be of advantage to the ratepayers and consumers if the supply of gas is in the hands of the Commissioners. He says the service will be better and cheaper in their hands than if it remained with the Company. The proportion of gas used for public lighting in Singapore is unusually large, and tends to increase. On this point Mr. Woodall says:

I do not think the public lighting will continue in the near future to be so large a percentage of the whole; but it is practically certain that the actual quantity of gas used by the Municipality will steadily increase. There are some situations where, even at a considerably higher cost, electric light will be preferred to gas; and, for the service of the very poor, where the total quantity of light required is small, gas will hardly be able to eject oil. With regard to the public lighting in Singapore, however, there is no room for hesitation. Gas presents the cheapest and most efficient method available, and will no doubt continue to be employed. This being so, there need be no fear of a falling off in the amount of business, but the contrary may be counted on.

Mr. Woodall deprecates the starting of new works in opposition to the Gas Company, as it would be an intolerable nuisance and great extravagance to have two gas-works and a duplicate system of mains. He advises the purchase of the present works (after some difficulty in arriving at a decision as to the proper basis of valuation) for the sum of £41,420. The Commissioners would have to raise £50,000; the annual charge for interest being £2250, or £560 less than the Company paid in dividends last year. Mr. Woodall goes on to say:

My confidence in the growth of the business in the hands of the Commissioners is strengthened because I feel assured they will adopt the prepayment (penny-in-the-slot) meter, which brings gas within the reach of the poorer people; also because there will be a greater disposition among ratepayers to use gas freely when they know that the profit earned from them as consumers will be returned to them in their capacity of ratepayers.

In my opinion, no scheme for the general lighting of Singapore can be complete which leaves electricity out of consideration. A prosperous community in a tropical climate will naturally desire the coolest light obtainable, even though the cost is high. I have said that for the public streets in Singapore electricity cannot compare with gas burned in Auer burners, either for efficiency or cost, and that therefore there can be no doubt as to the wisdom of taking in hand the supply of gas. But I am further and strongly of opinion that the Municipality will be placed in the best position to supply electricity at a reasonable rate for private purposes, because of their ownership of the gas supply.

In Singapore, the population likely to require electric lighting is not concentrated within a small area, but is grouped in places which are at a considerable distance apart. A general supply over the whole area would be very costly—so much so that the town could hardly face the expenditure for years to come. By means of the gas-mains, power is distributed over the whole town and suburbs. This power can be utilized for the generation of electricity in the immediate neighbourhood where a demand arises, and that at a comparatively economical rate both for capital and working.

My suggestion would be that an electric light station, fitted with gas-engines, be established in a position where, within a radius of not more than half-a-mile, it would command the busy portion of the European town, banks, offices, Government buildings, &c. The power might be sufficient to generate in (say) twelve hours, current sufficient for the day and night—the balance being stored. This would avoid the cost of a second shift of men, and the loss upon the small quantity stored would not be material. If this proved successful, then a similar station might be established in the residential district, in which case the Commissioners might require a guaranteed revenue from a sufficient number of householders to cover the cost of interest and working. Such installations are easily and immediately available; they would displace those already erected for individual consumers, would be efficient, and their capital cost low. At the same time, without interfering detrimentally with the business of the Gas Department, they would furnish an additional source of income and profit to the town.

Commenting on the report, the "Straits Times" says:

Mr. Corbet Woodall's report on the proposed acquisition of the Singapore Gas Company by the Singapore Municipality is so lucid and to the point in every subject touched upon, that we cannot foresee the possibility of any intelligent opposition to the scheme when it is brought before the consideration of the Commissioners. In the very outset of his report, Mr. Woodall lays it down as his professional opinion that it will be to the practical and financial advantage of the gas consumers as well as of the ratepayers of the town if the gas supply is in the hands of the Commissioners. He subsequently quotes his valuation of the plant to be purchased at a trifle over £40,000, and explains that its productive capabilities can be doubled at a further outlay of only £6000. In fine, he concludes that the Commissioners would have to raise a sum of £50,000, and that the interest on this amount, at the reasonable rate of 4½ per cent., amounts to only £2250, which is a sum £560 less than the dividend paid by the existing Company last year. In addition to this saving, he sets forth an economy in administration amounting to another £600; and, in fact, he proves that, without any increase in the revenue from the existing gas plant, the profit the Municipality would make in its first year's operations as a gas manufacturer—over and above all charges—would reach the sum of about £1200, to be used for a sinking fund or in extending the business. This is broadly what Mr. Woodall sets forward as his financial reason for recommending the purchase of the gas-works at the price he specifies; and the reason seems an eminently sound one. It is possible, however, that the Company may refuse to accept his valuation; but this seems a very remote contingency. At their last general meeting, the Company unanimously resolved to offer their undertaking to the Municipality for £45,000—stocks by valuation. But should this offer not be acceptable to the Commissioners, "the Company propose that Mr. Corbet Woodall be entrusted with fixing the price to be paid, with the sum of £45,000 as a maximum—stocks by valuation." The Municipality, if it makes the purchase, will no doubt take the coal, manufactured gas, and any other stock at a valuation; so in this respect there will be no difficulty. Then Mr. Woodall's valuation seems based on such fair and just deductions, that, though it is little more than half the original capital stock of the Company, it is a reasonable price for the goods that the Company now have to offer.

SHEPTON MALLET DISTRICT COUNCIL AND THE GAS-WORKS.

At the Meeting of the Shepton Mallet District Council last Tuesday, the Lighting Committee presented a report on the position of the Council in regard to the gas supply of the town, about which there has latterly been some complaint. In the course of it, they stated that, as the local Gas Company were not working under either a Provisional Order or a Special Act of Parliament, the Council could not instruct an examiner to test the quality of the gas under the provisions of Section 29 of the Gas-Works Clauses Act, 1871. If the Company were working under statutory powers, they would be compelled to supply gas of a fixed quality; and an examiner could be appointed to ascertain that they were doing so. In that case, however, the Company would be limited to a profit of 10 per cent., and anything extra must be used in reducing the price of gas. The Committee recommended the Council to proceed, under Section 161 of the Public Health Act, 1875, and apply for a Provisional Order to enable them to undertake to supply gas within their district. The Committee were advised that an Order would not be granted except on the terms of purchasing the works of the Company; but they were further advised that the price would not be anything like so much as it would be if the Company were working under a Private Act or an Order. The Committee made various recommendations on the subject submitted to them; and the Council proceeded to consider them. Mr. Norman suggested that the word "gas" be omitted, and "public lighting" substituted, so that the Council should not be confined to gas. Mr. Luff, the Chairman of the Committee, adopted the suggestion, with the view that the Council might be able to go in for electric lighting if they thought it better. Mr. Garton (Chairman of the Council, and Managing-Director of the Anglo-Bavarian Brewery, who have a private electric light installation) approved of the alteration; and the Council unanimously adopted the report as amended. It was afterwards decided to at once take the necessary steps for going into the whole question thoroughly; and the Committee were empowered to enter into negotiations with the Company to ascertain upon what terms they would be willing to dispose of their undertaking to the Council, and also to prepare a detailed report upon the whole subject, with the view of lodging an application for a Provisional Order.

ANOTHER GAS AND ACETYLENE EXHIBITION AT THE ROYAL AQUARIUM.

The Second Gas and Allied Trades and International Acetylene Exhibition will be held at the Royal Aquarium, Westminster, from Friday, the 21st inst., till Tuesday, the 22nd prox. Again organized by Mr. M. J. G. Ritchie, this promises to be an exhibition of more than usual interest, for a special feature will be the acetylene section, where it is proposed to demonstrate the progress this illuminant has made during the past twelve months. The success attending the first exhibition, opened about this time last year, has induced the Aquarium management to hope that the second one will prove still more so. The building offers peculiar advantages for an exhibition of the kind, as it occupies a fairly central position, and has a grand hall particularly well adapted for showing to the greatest advantage all kinds of illuminants. The exhibition will consist mainly

of apparatus for the manufacture and distribution of gas, and its utilization for cooking, heating, traction, and the production of power, including the latest types of gas-engines, appliances connected with the different systems of gas lighting, including compressors, mantles, burners, and art metal fittings, will be on view, also apparatus for showing the adaptability of acetylene for railway lighting, acetylene burners, fittings, &c. In the Acetylene Section, it is proposed that a Committee shall test the working of the various appliances during the period of exhibition, and award gold, silver, and bronze medals for the most efficient apparatus. The Committee for awarding the medals has already been formed.

ELECTRIC LIGHTING NOTES.

Colonel C. H. Luard, R.E., on behalf of the Local Government Board, held an inquiry at the Town Hall, Bexhill, on Thursday, for the purpose of hearing evidence with reference to an application from the Urban District Council for sanction to borrow £7772 for the purpose of electric lighting. Formal evidence only was given by the Clerk (Mr. Douglas) and Mr. L. Preece. The Clerk mentioned that £1500 was required for new machinery and £3300 for mains.

At last week's meeting of the Ilkley District Council, the Gas Committee recommended that a deputation should meet Mr. Gibbings and others, who are applying for a Provisional Order to light the district with electricity. Mr. Horn said that Mr. Gibbings turned out to be the Wharfedale Syndicate; and in this statement he was supported by Mr. Lister. Both gentlemen charged the Company with trying to take undue advantage. Mr. Horsman and Mr. Ellis (both members of the Syndicate) contradicted the statement, and disclaimed any interest in the electric lighting project at all. The minutes, after a long discussion, were confirmed.

The electric light works of the Leeds Corporation require enlargement; and, accordingly, at the meeting of the City Council last Wednesday, Alderman Wigram proposed that the Council approve the acceptance by the Lighting Committee of tenders amounting to £72,943 for the erection of buildings on the Britannia Mills site. He explained that the ultimate provision of power therein would enable the Corporation to deal with the supply of the entire city. The Committee had considered whether it would be wise to proceed with the erection of all the buildings at one time, or only a portion of them. It would be necessary, in any event, to put in the foundations and do the excavating work; and, having regard to the ultimate cost, the Committee recommended that the whole of the work should be proceeded with at once. The motion was carried.

At a special meeting of the Dorking District Council last Tuesday, it was decided to transfer their Electric Lighting Provisional Order to the West London and Provincial Electric Supply Company, Limited, on the terms of the Company's written offer, and subject to the Company agreeing to supply, if required, energy for electric lighting at the rate of not more than 2½d. per Board of Trade unit, and subject further to the Council having the right to purchase the undertaking at the end of the first ten years, or at any subsequent period of seven years. It was unanimously resolved to lodge a formal notice of objection to the application to be made by the County of Surrey Electrical Power Distribution Company, Limited, to the Board of Trade in the forthcoming session for a Provisional Order in respect of their district. The proposed transfer is subject to the approval of the Board of Trade; and, if sanctioned, the Council decided to engage Mr. Trentham to advise them upon the proposed scheme.

Some further information was given at a meeting of the Paignton District Council yesterday week with reference to the offer of Mr. Singer, a wealthy local resident, to provide electric lighting works for the town. The Electric Lighting Committee of the Council have met Mr. Singer, and discussed the matter with him. They reported that he would erect and equip the works at his own expense, and the Council would have the option of purchasing the undertaking at the end of a number of years to be agreed upon, without paying anything for goodwill. The charge for current would be 5d. per unit, with ½d. per unit for wiring; making a total of 5½d. per unit. In the event of the Local Government Board declining to sanction the raising of a loan for the purchase of the works, Mr. Singer suggested that the Council, when they could afford it, might take over the works, and pay him by instalments spread over a specified number of years. More generous terms can hardly be imagined. As will be seen, Mr. Singer takes all the risk; and if the venture is a success, the ratepayers may, if they choose, take all the profit.

Referring to Mr. Corbet Woodall's report on the proposed acquisition of the gas-works and the supply of electricity by the Municipality of Singapore, some extracts from which are given in another column, the "Straits Times" says: "Mr. Woodall expresses views on the probable future necessity of an electrical supply for private purposes that prove interesting reading. He recognizes the difficulty in the way of supplying electricity to the residential districts, and suggests a system of gas supply, for the generation of electricity in remoter houses, which system at present seems a trifle visionary. His proposal for a central electric light station, fitted with gas-engines, for the supply of electric light to the banks, offices, Government buildings, &c., seems far more practical, and would be commendable did real demand for electric lighting exist in the business portion of the town. As a rule, however, practically no business is done in the central European district after sundown; and we believe that the demand for an electric light supply would be too small there to justify the erection of a plant. The idea of a plant in the residential district, with a guaranteed revenue from a sufficient number of householders to cover the cost of interest and working, sounds less Utopian. Still, in this country and climate, electricity has so many disadvantages that it can scarcely be expected to oust gas as an illuminant, even for private purposes, until the methods of its production and distribution can be materially improved upon. It costs some money to turn coal into gas; it costs still more money to turn gas into electricity. Then, with the electricity ready produced, we have beetles and mice, and all sorts of things, to eat the insulation off the wires; and we have eternal dampness to rot it. This ensures uncertainty of supply; whereas with gas, the supply is a practical certainty if once the pipes are laid properly."

At the stroke of midnight on the 30th ult., the electricity supply works at Colchester passed into the hands of the Corporation. In announcing this fact at the meeting of the Town Council last Wednesday, the Chairman of the Electric Light and Power Committee (Mr. E. H. Barritt) explained the position of the electric light in the borough. He said that during the first year of the undertaking—from December, 1898, to December, 1899—the work proceeded quietly. Eighty consumers, and 4254 lamps, were connected with the mains; and it was then only necessary to run the plant for a few hours on five evenings in the week. Towards the close of the first year, the increasing demand for current began to make itself felt; and the Council took steps to provide additional steam power and generating plant. These were not installed a day too soon. The year from December, 1899, to December, 1900, had been a very busy one. The consumers had increased from 80 to 148, and the number of equivalent 8-candle lamps had gone up from 4254 to 9421; the difference in units between the year just closed and the previous one being 88,131, against 44,432. They were starting the third year with a double shift of men, and the plant had to be kept running 17 hours out of the 24. The generating plant consisted of four sets, three of which were capable of developing 110-horse power each; while one could develop 360-horse power. The "load curve" for the 30th ult. showed a good early morning load, a continuous day load, and a very heavy night load, the apex of which was reached about 5.30 p.m. The position each Friday night was that the three smaller sets were not sufficient to create the necessary current demanded. The largest set had to be relied upon entirely; and if this became disabled, parts of the town must for a short time be left in darkness. The Committee believed that during the coming year the rate of increase would be more than maintained; and if the Council were able to reduce the price of the current, the increase would be undoubtedly rapid. The Committee were constantly receiving communications from all quarters of the town for a supply of electricity for lighting or heating purposes. To meet future requirements, they had made several important recommendations. First, in order to meet the increasing demand for current, they proposed to add another 250-horse power set, bringing the total up to 940-horse power. This would enable them to deal with 20,000 equivalent 8-candle lamps. The proposed new set would just fill up the remaining space in the engine-house, and the sets could be used for either lighting or traction. It was proposed to add another 400-horse power condenser, and to erect a cooling-tower. The Committee had also to deal with overloaded mains. There were two ways of doing this—one by making the mains bigger, and the other by increasing the pressure; and the Committee suggested the second course as the least expensive. It was proposed to raise the voltage from 105 to 420, and thus give every main four times its present carrying capacity. The Committee required a loan of £12,000. The report was adopted.

Failure of the Water Supply at Bedworth.—Bedworth, an important Warwickshire mining centre, is in danger of a water famine owing to the failure of one of the chief sources of supply. Water is now being distributed from carts. Boring operations are in progress with a view to finding a further yield.

New Joint-Stock Companies.—The Kimbolton Gas and Coke Company has been registered with a capital of £1500, in £1 shares, to take over the business of the present Gas Company at Kimbolton, in Huntingdonshire, and to manufacture and supply coal gas or other inflammable gas or artificial light. The Continental Incandescent Gas-Light Company, Limited, has been registered with a capital of £5000, in £1 shares, to adopt an agreement with J. Boehm for the acquisition of his business relating to the sale of incandescent lighting accessories in the United Kingdom, and to carry on the business of burner, mantle, and other fittings and appliance manufacturers and merchants, &c.

Bridlington Gas Supply.—It is stated in Bridlington that Messrs. Whitaker Bros., the promoters of the New Spa Company, and the owners of the South Burlington Estate, intend at an early date to make application to the Board of Trade for a Provisional Order to enable them to manufacture and supply gas on the estate and sections of Hilderthorpe not covered by the Bridlington Gas Company. It is understood that the recent action of the Gas Company in declining to lay mains for the lighting of certain parts of the district at the request of the Corporation has induced Messrs. Whitaker to consider the advisability of taking the step which may lead to the erection of gas-works on the south side.

A Gas Stoker Accidentally Suffocated.—A short time ago, Charles Smith, 28 years of age, a stoker at the Twyford Gas-Works, was found by the Manager (Mr. T. Watson Little) sitting upon a block of wood in the retort-house, about half-past seven one morning, apparently asleep or in a faint. Closer investigation, however, revealed a condition which led to the police being informed and a medical man summoned. On his arrival, he expressed the opinion that Smith had died from suffocation; and had been dead for three or four hours. At the Coroner's inquiry, it was stated that he had been on night duty for rather more than two months, and did his work satisfactorily. The conclusion come to was that deceased had gone to sleep in the retort-house, which, although properly ventilated, was necessarily warm, and had been overpowered; but it was stated that he might have sat in the workshop, and had evidently been lying down there during the night. A verdict was returned that he met with his death through being accidentally suffocated.

Poisoning by Gas.—Unfortunately, another death, making the third, has resulted from the gas poisoning at Renton, in Dumbartonshire, as noticed last week (p. 1417). It may be remembered that Mrs. Follan, the wife of the man who was found dead, was removed from the house unconscious; and she never recovered. The family living in the adjoining house were seriously affected, and were for a long time in a dangerous condition. Mrs. Margaret Gillespie, residing at No. 86, Seymour Street, Shawlands, Glasgow, was found by her son last Tuesday morning sitting unconscious in a chair in the kitchen. The apartment was full of gas, and the bracket was turned on and unlighted. A medical man was summoned; but the unfortunate woman died some hours later. At Halifax, last Friday, an inquest was held on the body of Herbert William Sutcliffe, 27, a brass finisher, who was found dead in his bed on the previous day. The gas unlighted was turned on full, and the crevices of the bedroon and the chimney had been blocked up. He had left on the table a letter signed "Herbert William Sutcliffe, the outcast," in which he said he destroyed himself because no one seemed to want him. A verdict of "Suicide during temporary insanity" was returned.

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The Brass Plate has holes around its edge, numbered; these indicate the feet delivered for the Coin used
To set the Meter, note Figs. I., II., III, IV.

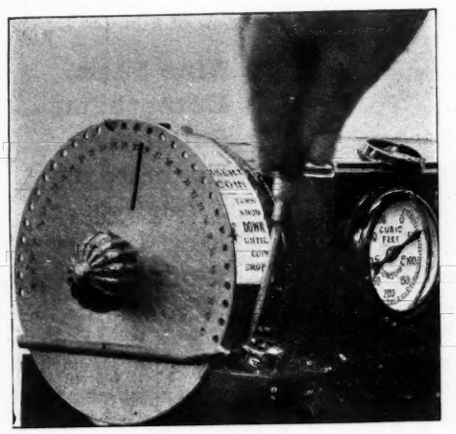

Fig. I.
Break Company's Seal and Remove Screw—THUS.

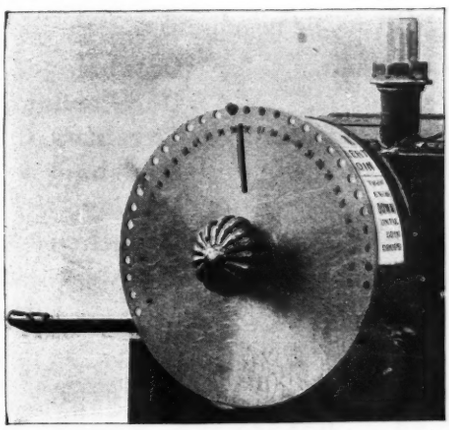

Fig. II.
Swing Band Back—THUS.

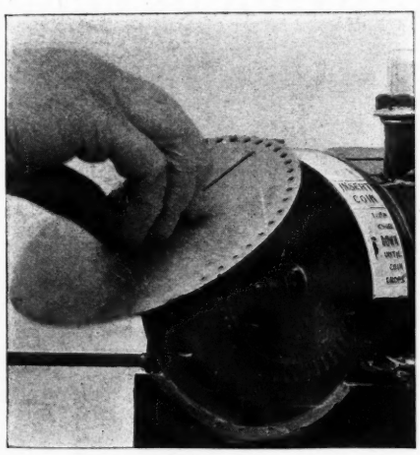

Fig. III.
Lift Plate Off—THUS.

Fig. IV.
Replace Plate—THUS.

Swing Band Forward—Replace Screw—and Re-seal.

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GIVES A CONSTANT AND STEADY OUTLET PRESSURE UNDER ALL CONDITIONS.

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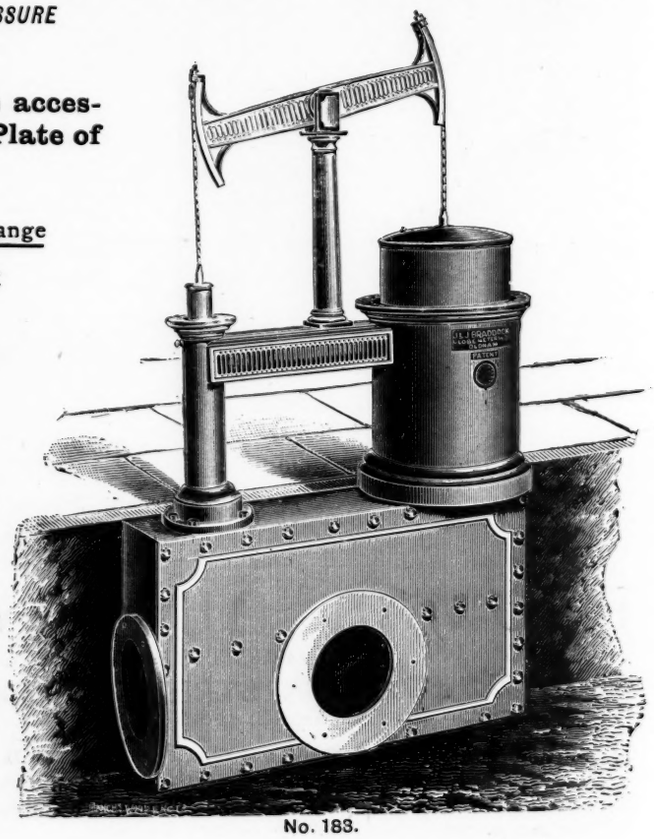
The Inlet and Outlet may be as Illustrated, or at opposite ends (or sides) of the Valve-Chamber.



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LONDON COUNTY COUNCIL AND THE WATER COMPANIES.

At the Meeting of the London County Council to-day, the Parliamentary Committee will present the following report on the subject of the Bill they have prepared, in pursuance of the Council's instructions, to sanction the purchase, either by agreement or on arbitration terms, of the undertakings of the Metropolitan Water Companies:—

It is not necessary for us to enumerate the many questions which necessarily arise in settling the provisions of a Bill to deal with the long outstanding problem of the water supply of London; but we desire to point out that, when considering the lines upon which the Bill should be drafted, we have had due regard to the policy which has already been laid down by the Council, and also to the recommendations contained in the report of the Royal Commission on the Metropolitan Water Supply, published in January last. The Bill we present provides for the purchase by the Council, either by agreement or on arbitration terms, of the undertakings of the Companies. In the event of no agreement being arrived at, the Bill provides, as did the Bill of last year, for the appointment of an arbitrator or arbitrators, to be named by Parliament in the Bill, to determine as to the amount of the purchase-money to be paid. It appears to us that this procedure will result in the selection of some eminent person or persons, and secure that the arbitration will be carried out in a manner most efficient and satisfactory to all parties concerned.

The provision dealing with the lines upon which the arbitrators shall arrive at such amount differs from the clause in the Bill of last year in some respects. We have inserted words to provide that no allowance shall be made in respect of the compulsory purchase of the undertakings of the Companies; and, in this connection, we may remind the Council that the Royal Commission in their report (paragraph 55) say that "it would be improper for an arbitrator to give any compensation in the nature of a *solatium* of that kind." It appears to us that the clause which we have adopted substantially carries out the views expressed by the Commission with regard to the principles which should guide the arbitrators in determining the amount of the purchase-money.

With regard to the management of the water supply when purchased, the Bill provides that the Council shall appoint a Committee, which may comprise representatives of other bodies and persons not being members of the Council, and may delegate to such Committee any powers with reference to the management and administration of the supply. This is not in accordance with the decisions arrived at by the Royal Commission who recommend (paragraph 147) that a permanent Water Board should be created, constituted as follows: The Chairman and Vice-Chairman appointed by the Local Government Board; ten members appointed by the London County Council; two by the Middlesex County Council; two by the Surrey County Council; two by the Essex County Council; two by the Hertford County Council; two by the Kent County Council; four by the Thames Conservancy Board; two by the Lea Conservancy Board; and two by the West Ham Corporation. We have been unable to adopt this recommendation as affording a just representation of London on the proposed Board; and when we point out that three-fourths of the population supplied by the Companies reside in London, and that of the rateable value upon which water-rate is charged 84 per cent. is within the county, we are convinced that our view will be endorsed by the almost unanimous opinion of the Council.

With regard to the question of the severance of works and sources of supply among authorities outside London, dealt with in the report of the Commission, we have drafted the Bill so as to accord with the decision of the Commission, who report (paragraph 137) that such severance "would be very difficult and highly undesirable." The Bill, however, provides power to enable the Council and extra-Metropolitan County Councils and Local Authorities to enter into agreements whereby the Authorities of districts outside London may purchase from the Council a supply of water in bulk, and also the necessary mains, pipes, and works of distribution.

We have given instructions for copies of the Bill to be circulated to the members of the Council, and we recommend—"That the London Water (Purchase of Companies) Bill be approved; that the seal of the Council be affixed to a petition for leave to bring in the Bill; and that the Bill and petition be deposited pursuant to the Standing Orders of Parliament, with such necessary alterations (if any) in the Bill as the Parliamentary Committee may consider desirable."

The Committee will also present the following report on the Metropolitan Water Companies (Amendment of Acts) Bill:—

We have had under careful consideration the resolution of the Council on May 29 last instructing us to prepare a Bill for introduction in the next session of Parliament to provide that, in the event of a Bill being passed for the purchase of the Water Companies' undertakings before the end of 1908, the clauses in the several Acts of the Companies known as the "sterilization" clauses shall be deemed to be in operation up to that date. The effect of the sections in question is to provide that the purchase price to be paid for the undertaking or undertakings of any Company or Companies shall not be enhanced by any advantages conferred on such Company or Companies by the respective Acts in which the sections are contained, in the event of such purchase being effected within a limited period prescribed in the several Acts. The Acts in which "sterilization" sections are contained are the following: Southwark and Vauxhall Water Acts, 1884 and 1898; Staines Reservoirs Acts, 1896 and 1898; Metropolis Water Act, 1899; Lambeth Water Act, 1900; and East London Water Act, 1900. The period prescribed for the operation of the sections is seven years from the dates of the passing of the several Acts, except in the cases of the Southwark and Vauxhall Act, 1898, which prescribes ten years, and the Staines Reservoirs Act, 1898, to which is extended the section contained in the Staines Reservoirs Act, 1896, providing a period of seven years from that date. It will thus be seen that in the case of the limit of seven years in the Southwark and Vauxhall Act, 1884, the period for the operation of the section has already expired; and by reason of the fact that no purchase of the undertakings has been effected by a public body, all advantage conferred by the section has been lost. The Acts which we have mentioned above are all Private Acts, with the exception of the Metropolis Water Act, 1899, which is a public statute. We are advised that a proposal for amending both private and public statutes by means of a single Bill would lead to technical difficulties in Parliament, and we have also borne in mind that the Act of 1899 was a measure put forward by Her Majesty's Government. It appears to us, therefore, that the Council's proposal should be limited to an amendment of the Private Acts of the Companies in which the operation of the "sterilization" sections expires before 1906—that is to say, the Staines Reservoirs Acts affecting the New River, West Middlesex, and Grand Junction Companies. By this means the Staines Acts will, so far as the matter in question is concerned, be placed in line with the Government measure of 1899, and the technical difficulty mentioned above will be avoided. We have drafted the Bill on the assumption that the Council will approve of its proposal being limited to an extension to 1906 instead of 1908, which is the year mentioned in our instruction. The limitation will also enable us to avoid any amendment of the Lambeth and East London Acts of 1900, in which the sections operate until 1907. We have given instructions for copies of the Bill to be circulated to the members of the Council, and we recommend—"That the Metropolitan Water Companies (Amendment of Acts) Bill be approved; that the seal of the Council be affixed to a petition for leave to bring in the Bill; and that the Bill and petition be deposited pursuant to the Standing Orders of Parliament, with such necessary alterations (if any) in the Bill as the Parliamentary Committee may consider desirable."

DORKING WATER-WORKS PURCHASE.

Action of the Company's Officials Protested Against.

On Thursday, at the Meeting of the Dorking District Council, the Clerk read a letter addressed by the Chairman (Mr. J. W. Palmer) to Mr. W. J. Down, the Secretary of the Dorking Water Company, in which the writer said he felt compelled to call the attention of the Company to the opposition to the Council's Bill, which was now being "fostered and organized." Mr. Down, he wrote, would remember that the Company obtained their 1900 Act only through the intervention of the Council. The Bill was thrown out by the Lords on the petition presented by the Council; and had not the Council then come to the assistance of the Company, the Act would not now be in existence, and the Company would be in such a grave financial position (having to expend revenue moneys for capital purposes) that the end could not have been postponed long. An important point which the Council had in view at the time it was agreed to withdraw opposition to the Bill was the inclusion of the Council's clause, which clause now formed a part of the Act, that the Company should not oppose the application of the Council for a Bill to take over the undertaking. He was led to believe that some of the Directors of the Company were doing all they could with the view of inducing the electorate to vote against the initial proceedings of the Council; and he was led to believe that some of the Company's employees were also engaged in the same work. The action being taken was, in his (the Chairman's) opinion, a distinct breach of the understanding on which the Company obtained their Act, and a mere evasion of the Council's clause in the Act; for it was impossible for the Directors or their officers to dissociate themselves from the position they held in the Company. As Chairman of the District Council, he desired to record his strong protest against such proceedings. He wished, however, to exclude the name of the Chairman of the Directors from any remarks he had made. To this, Mr. Down replied to the effect that, so far as he was aware, no opposition was being, or had been, fostered or organized by the Company or anyone connected therewith. The Chairman observed that he implicitly took Mr. Down's answer to his letter. He did not believe that Mr. Down would quibble over the interpretation of the words "fostered or organized;" but he did think that, if Mr. Down took the trouble to make inquiries, he would ascertain that his (the Chairman's) statements had some foundation in fact. He thought it would be admitted that the Council, in the exercise of a public duty, pressed forward a matter which was the most important financial measure which had ever been laid before the town for its consideration. The Council had acted not only from a sense of duty, but also with great moderation and a sense of fair play; and he thought that they were entitled to the same treatment from the Water Company. They would remember that when the Bill was first printed he and another member of the Council waited upon the Directors of the Company, and formulated certain terms for the purchase of the undertaking, which terms were, in their opinion, very fair and reasonable. The Directors, however, refused to accept them. Petitions were thereupon presented against the Bill, which was thrown out. They quite realized the strength of their position when the Bill was thrown out. They realized that the Council were in a position to dictate almost any terms they chose to make to the Company; and the Directors would either have to accept those terms or lose their Bill. In the first place, the Council agreed to take over the water undertaking within three years, whereas they might have fairly stipulated for ten years. In the second place, they agreed to accept one-half of the cost of the petitions; whereas they were fully entitled to ask for the whole of the amount, inasmuch as the Directors refused to entertain a very fair and reasonable offer. They also agreed to pay 10 per cent. over and above the value of the undertaking. These were, he thought, points sufficient to show that they had behaved with every fairness to the Company. One of the points in the clause was that the Company should not oppose the Council's Purchase Bill. Mr. Down, in his letter, did not take exception to the line he (the speaker) had pointed out, that neither the Company nor their officers had a right to oppose the Council's initial proceedings. What, however, were they to think when they found that a Director of the Company led the opposition to the Bill at a public meeting? What were they to think when persons interested held before the electorate the bogey of a 9d. rate? And what were they to think when others interested were scouring the district for the purpose of inducing owners to register their votes against the Bill? He ventured to say that they had every reason to look upon this proceeding as a distinct breach of the engagement entered into between the Council and the Company, and as distinctly illegal. Assuming the Company had an entirely free hand, did they not think it playing the game rather low down to start the bogey of a 9d. rate? There were absolutely no data for such an assertion; but he believed there were good grounds for believing that, instead of the rate being increased by 9d., it would not be increased by more than 1d., after the cost of the undertaking was divided between them and the other Council interested, and would only last a comparatively brief time.

EXTENSION OF THE LOWESTOFT WATER-WORKS.

Arbitration Proceedings.

At the Surveyors' Institute, Westminster, last Tuesday and Wednesday, Mr. J. Green (Messrs. Weatherall and Green, Chancery Lane) sat as Umpire to assess the compensation to be paid to Colonel Stewart for lands acquired, under the Lands Clauses Act, by the Lowestoft Water and Gas Company, for the purposes of their water undertaking. Mr. F. Hornor, F.S.I., was Arbitrator, and Mr. J. A. Cripps, Q.C., and Mr. Buckmaster were Counsel for the claimant; Mr. C. W. Stephenson, F.S.I., was Arbitrator for the Company, for whom Mr. Balfour Browne, Q.C., and Mr. Honoratus Lloyd appeared. From the opening statement of Mr. Buckmaster, it appears that the land taken is 20 acres 2 roods 20 perches in extent, belonging to Colonel Stewart, the owner of the Hopton Hall Estate of about 70 acres. The estate is favourably situated 1 mile from the sea, 4 miles from Great Yarmouth, and 5 miles from Lowestoft. It was purchased by the claimant in 1887 for £3000, which was £2000 less than the previous owner had paid for it; and since he came into possession, Colonel Stewart had expended £1800 on the property. The Hall is at present let furnished to a Mrs. Abbott, for £240 a year. The present water-works of the Company are situated at the end of Fritton Broad; and the Company are authorized to take water from the Hopton River for the purposes of their undertaking. The Company have been gradually acquiring land at each side of the brook, to preserve the water from pollution. The portion of the land taken is, in the opinion of Colonel Stewart, an important part of the estate; and the loss of it will interfere much with the view from the Hall. Colonel Stewart having given evidence as to the above facts, Mr. S. M. Mills, Surveyor, of Norwich, gave a valuation amounting to £3901. This was made up of £810 for land, £50 for timber, £615 for cottage and buildings, £150 for loss of access to pastures, £250 for shooting rights, £900 for general damages and severance, and £1000 for loss of water. In cross-examination, Mr. Mills stated that the land was let at 15s. an acre, which was a fair rent for it for agricultural purposes. Mr. J. T. Bottle, Architect and Surveyor, corroborated this valuation; then Mr. E. H. Tewson, Surveyor, of London, valued the land at £2929. In his opinion, the whole estate was well worth £6800; and the value of the land taken was, to a residential owner, at least £40 an acre. Mr. Lloyd contended that the claim was exaggerated, and that the land, which was simply agricultural, was of small value; the whole estate, including the Hall, having been bought for £3000. Mr. J. C. Miles, Auctioneer and Valuer, of Great Yarmouth, fixed the amount of compensation at £1330 4s. 6d.; Mr. T. W. Gaze, of Diss, at £1318; and Mr. W. H. Elwell, Surveyor, of London, at £1337. Mr. Joseph Hawkesley, Engineer and Manager of the Water Company, said they were empowered to take the water from Hopton River. All they proposed to do was to remove the peat from the stream, to avoid contamination. This would involve no interference with Colonel Stewart's wells; and they had no intention of pumping. This concluded the evidence. Mr. Cripps replied; and the Umpire reserved his decision.

On Thursday, Mr. A. Savill presided as Umpire in a claim by Sir Saville Crossley against the same Company. Mr. Bidwell, F.S.I., was Arbitrator for the claimant; and Mr. Stephenson again represented the Company. Mr. Jelf, Q.C., and Mr. Moon appeared for Sir Saville Crossley; Mr. Balfour Browne, Q.C., and Mr. Lloyd for the Company. The claim was for the value of lands—the Decoy Farm and others—amounting to 42 acres, adjacent to the lands in the preceding case, a farm house, buildings, and timber, and for general damage to the estate, sporting rights, and loss of shelter and water. The valuation of Mr. H. Salter, of Attleborough, was £6135; Mr. Garrett Taylor, of Norwich, £5956; Mr. Kerry Rix, the Agent of the claimant, £6460; and Mr. E. Tewson, £6134. Mr. Tewson said he considered £6000 a fair and proper compensation. The estate had valuable sporting rights; and his experience was that, while agricultural rents were going down, sporting rents were increasing. Mr. Balfour Browne urged that the witnesses had greatly exaggerated the value of the land and the sporting rights. On behalf of the Company, Mr. T. W. Gaze estimated the compensation at £3140; Mr. J. C. Miles, at £2960; Mr. Notley, of Lowestoft, at £2871; and Mr. W. H. Elwell, at £3201. This, they considered, full and ample compensation. Mr. Jelf replied; and the Umpire reserved his award.

HEANOR AND ILKESTON JOINT WATER SCHEME.

At a Special Meeting of the Ilkeston Town Council held last Tuesday, the Mayor (Mr. R. Hunt) read a letter from the Water Engineers, Messrs. Hodson, of Loughborough, pointing out the advantages of the Meerbrook Sough water scheme over other proposed sources. Local supplies were, they said, entirely out of the question. The quantity of water which could be obtained at any one or two spots was insufficient; and it was liable at any moment to abstraction by mining operations. The Meerbrook Sough water was unexceptionable, and afforded the prospect of a safe supply. The flow in the drain was from 14 to 19 million gallons daily; and as the Corporation only proposed to take 2 million gallons at the utmost, which only represented 3-horse power on a 10 feet fall, if compensation was awarded by the Parliamentary Committee it could not be unduly heavy. As for the hardness of the water, it was 22·1 as against 37·2 in the present town supply; being about the same hardness as London water. Mr. Richardson, in accordance with notice, moved—"That the Borough Surveyor be instructed to report upon and prepare an estimate of the cost of laying down throughout the borough a new and separate water service for the supply of water to be used for drinking purposes only." He said he believed it would be possible to deal with their water supply without going to the expense of a scheme of the magnitude of the one proposed, which had been rushed upon them with too much haste. He thought the two sources of supply at Kirk Hallam and Nutbrook would yield sufficient water to last the town a number of years; and the water derived from the Kirk Hallam shaft was admittedly a pure and wholesome one. Mr. Gregory seconded the motion; and Mr. Wood supported it

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1446.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
690,000	10	Oct. 12	10½	Alliance & Dublin	10 p. c.	19—20	..	5 5 0	60,000	5	Sept. 28	7	Ottoman, Ltd.	5—5½	..	6 7 3
100,000	10	,,	7½	Do.	7 p. c.	18—14	..	5 7 2	500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106*	..	5 13 2
800,000	100	July 2	5	Australian	5 p. c. Deb.	101—103	..	4 17 1								
200,000	5	Nov. 14	6	Bombay, Ltd.		6—6½	..	4 12 4	851,070	10	Oct. 12	7	River Plate Ord.	10—10½	..	6 13 4
40,000	5	,,	6	Do. New, £4 paid		4—4½	..	5 6 8	250,000	Stk.	June 28	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
880,000	Stk.	Aug. 15	12	Brentford Consolidated		245—255	..	4 14 1	250,000	10	Sept. 28	8	San Paulo, Ltd.	11—12	..	6 13 4
270,000	,,	,,	9	Do. New		177—182	..	4 18 11	185,000	Stk.	Sept. 14	10	Sheffield A.	234—239	..	4 3 8
50,000	,,	,,	5	Do. 5 p. c. Pref.		137—142	..	3 10 5	209,700	,,	,,	10	Do. B.	234—239	..	4 3 8
159,375	,,	June 14	4	Do. 4 p. c. Deb.		116—120	..	3 6 8	447,427	,,	,,	10	Do. C.	232—237	..	4 4 5
220,000	Stk.	Sept. 14	10	Brighton & Hove Orig.		220—230	..	4 6 11	5,641,885	Stk.	Aug. 15	5⅝	South Metrop., 4 p.c. Ord.	131—134	+3	3 19 7
226,320	,,	,,	7	Do. A. Ord. Stk.		145—155	..	4 10 4	1,520,000	,,	July 12	3	Do. 3 p. c. Deb.	95—98	..	3 1 3
1,009,500	Stk.	Aug. 29	5	Bristol, 5 p. c. max.		117—118	..	4 4 9	380,940	Stk.	Nov. 14	5	Southampton Ord.	107—112	..	4 9 3
420,000	20	Sept. 28	10	British		39—41	..	4 17 7	70,825	,,	July 12	4	Do. 4 p.c. Deb.	117—122	..	3 5 7
50,000	10	Aug. 15	12	Bromley, Ord. 10 p. c.		24—26	..	4 12 4	120,000	Stk.	Aug. 30	6	Tottenham and Edmonton A. 5 p.c. B. 3½ p.c. 4 p. c. Deb.	112—117	..	5 2 7
79,000	10	,,	9	Do. 7 p. c.		19—21	..	4 5 8	250,520	,,	,,	4½		83—88	+3	5 2 3
500,000	10	Oct. 12	6	Buenos Ayres (New) Ltd.		8—8¼	..	7 1 2	61,550	,,	June 14	4		111—115	..	3 9 7
220,000	Stk.	June 14	4	Do. 4 p. c. Deb.		97—99	−1	4 0 10	182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
150,000	20	July 12	8½	Cagliari, Ltd.		23—25	..	6 12 0	149,900	10	July 2	5	Do. 5 p. c. Deb. Red.	98—102	..	4 18 0
100,000	10	Sept. 28	8	Cape Town & Dis., Ltd.		13¾—14½	..	5 10 4								
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.		53—55	..	5 9 1								
550,000	Stk.	Oct. 12	12⅔	Commercial Old Stock		270—275	..	4 12 8								
236,425	,,	,,	9½	Do. New do.		205—210	+2½	4 12 10								
388,237	,,	June 14	4½	Do. 4½ p. c. Deb.		133—138	..	3 5 3								
800,000	Stk.	May 31	9	Continental Union, Ltd.		175—180	..	5 0 0								
200,000	,,	,,	7	Do. 7 p. c. Pref.		168—173	..	4 0 11								
51,600	Stk.	—	14	Croydon A	10 p. c.	—	..	—								
178,400	,,	—	11	Do. B	7 p. c.	—	..	—								
555,000	Stk.	Aug. 15	5½	Crystal Palace Ord.	5 p. c.	117—122	..	4 6 1								
60,000	,,	,,	5	Do. 5 p. c. Pref.		130—135	..	3 14 1								
486,090	10	July 27	11	European, Ltd.		19—20	..	5 10 0								
354,060	10	,,	11	Do. £7 10s. paid		13¼—14½	..	5 13 9								
14,993,075	Stk.	Aug. 15	4 4/5	Gas-light and Coke	4 p. c. Ord.	97—99	..	4 8 10								
2,600,000	,,	,,	3⅘		3½ p. c. max.	92—94	..	3 14 6								
3,799,735	,,	,,	4		4 p. c. Con. Pref.	115—118	..	3 7 10								
3,993,975	,,	June 14	3		3 p. c. Con. Deb.	95—97	..	3 1 10								
70,000	10	Oct. 26	8	Hongkong & China, Ltd.		13—14	..	5 14 4								
3,800,000	Stk.	Nov. 14	10	Imperial Continental		202—207	..	4 16 7								
473,600	Stk.	Aug. 15	3½	Do. 3½ p. c. Deb. Red.		100—102	..	3 8 8								
75,000	5	June 14	6	Malta & Medn., Ltd.		4¾—5¼	..	5 14 3								
560,000	100	Oct. 1	5	Met. of	5 p. c. Deb.	105—108	..	4 12 7								
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	104—106	..	4 4 11								
541,920	20	Nov. 14	3½	Monte Video, Ltd.		9½—10¾	..	6 13 4								
667,946	Stk.	Aug. 30	9½	Newc'tle & Gatesh'd Con.		210—215	..	4 6 1								
299,855	Stk.	June 28	3½	Do. 3½ p. c. Deb.		104—107	..	3 5 5								
150,000	5	Nov. 29	8	Oriental, Ltd.		7—7⅞	..	5 6 8								
135,000	5	,,	8	Do. New, £4 10s. pd.		5⅞—6¼*	..	5 15 3								
15,000	5	,,	8	Do. do. 1879, £1 pd.		1¼—1½*	..	4 11 6								
					*Ex. div.									*Ex div.		
									780,404	Stk.	June 28	11	Chelsea, Ord.	307—312	..	3 10 6
									150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
									160,000	,,	,,	4½	Do. 4½ p. c. Pref.	143—148	..	3 0 10
									175,785	,,	Sept. 28	4½	Do. 4½ p. c. Deb.	143—148	..	3 0 10
									1,720,560	Stk.	Oct. 12	7	East London, Ord.	198—198	..	3 10 8
									654,740	,,	June 14	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
									797,687	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
									700,000	50	June 14	8†	Grand Junction 10 p.c. max. 4 p. c. Deb.	110—113	..	3 10 10
									810,000	Stk.	Sept. 28	4		130—135	..	2 19 3
									708,000	Stk.	Aug. 30	14	Kent	303—308	+3	4 10 11
									160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
									1,043,800	100	June 28	10½	Lambeth, 10 p. c. max.	295—300	..	3 10 0
									406,200	100	,,	8	Do. 7½ p. c. max.	207—212	..	3 15 6
									350,000	Stk.	Sept. 28	4	Do. 4 p. c. Deb.	127—130	..	3 1 7
									500,000	100	Aug. 15	14	New River, New Shares	415—420	..	3 6 8
									1,000,000	Stk.	July 27	4	Do. 4 p. c. Deb.	128—133	..	3 0 2
									902,300	Stk.	June 14	7½	South-wark and 5 p.c. Pref.	195—200	−5	3 15 1
									136,500	100	,,	7½		188—193	..	3 17 9
									489,200	Stk.	,,	5		155—160	..	3 2 6
									1,019,585	,,	Oct. 12	4	Vauxhall 4 p. c. A Deb.	128—133	..	3 0 2
									1,155,066	Stk.	June 14	10	West Middlesex	280—290	..	3 9 0
									200,000	,,	,,	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
									200,000	,,	Sept. 14	3	Do. 3 p. c. Deb	97—99	..	3 0 7
														*Ex div.		

† Next dividend will be at this rate.

although it was not quite in accordance with his own views. He said they had plenty of water at Kirk Hallam and Little Hallam to last twenty or thirty years, without going to the Meerbrook Sough at all, especially as they were uninformed as to the cost of carrying out the scheme. The Mayor said he believed the Council ordered the Water Committee to be appointed for the purpose of going thoroughly into the Meerbrook Sough scheme. They passed a resolution instructing them to consider the question with a view to carrying out that scheme; and he did not see why they should be engaged in the present discussion. After a great deal of debate, the resolution was put to the meeting and lost—only five votes being given in favour of it. At the monthly meeting of the Heanor District Council the next day, it was decided to sanction an agreement between the Council and the Ilkeston Corporation for carrying out a joint scheme for supplying water to the two places; any dispute arising between the parties, when constituted a Joint Board, to be referred to the County Council for settlement.

THE USE AND WASTE OF WATER.

Our readers will have learned, from what has already appeared in the "JOURNAL" (see *ante*, p. 1036), that the Merchants' Association of New York are taking keen interest in the question of the water supply of the city. The Engineering Committee of that body, the constitution of which has already been recorded, have had presented to them, by Mr. J. R. Croes, an important report on the subject of the use and waste of water, the following extracts from which appeared in a recent number of the "Engineering Record."

The most reasonable and practical basis of computation for the amount of water used appears to be to consider the number of miles of distributing pipe in connection with the number of taps or separate connections supplying buildings. The mileage of main-pipes enters as a factor into the public use of water for street cleaning, fire protection, sewer flushing, and like purposes. Such use is governed almost entirely by the length of pipe laid, and not by the population.

There is much leakage of water underground from bad joints, breaks, and defective stoppage of disused services. There are, on the 850 miles of mains in New York, at least 18,000 old service-taps which have been brought into disuse and more or less imperfectly plugged up. Thousands of them are leaking continuously—some only a mere dribble, but others carrying off into the subsoil and into the sewers thousands of gallons daily each. If the underground channels become obstructed, the water will rise to the surface, and the leak will be reported. Every increase of pressure in the pipes augments the leakage from these old taps, and attention is called to them. The number of leaks which showed themselves, when the pressure on the mains was kept down on account of scarcity of water between 1883 and 1889, was about 700 annually. After the new aqueduct was finished, and the pressure was raised, the number reported was upwards of 1000 annually; and last year, after the full pressure had been turned on in the lower part of the city, there were 2500 of such leaks which made themselves manifest. In the basements of buildings, and in vacant lots lying below the street, and even on the surface of the street itself, springs may be noticed by an observer every day which are caused solely by leaks in service-pipes and mains.

The mains themselves also leak largely. There are at least 500,000 joints in the main-pipes underground, and from many of them water is escaping. Indeed, instances have occurred in which the excessive amount of water encountered in the excavation of a pit in the street has been traced to a joint in a main water-pipe which had never been leaded at all by the contractor, and from which several hundred thousand gallons a day had been flowing for years into a sandy subsoil, and been carried off by the sewers. Cases of leakage are constantly occurring in which the source is traced to corroded cast-iron mains. For several years the average quantity of old pipe which has had to be taken up and replaced has been about two miles annually; but the deterioration and consequent leakage from the old pipes is progressing more rapidly than the work of replacing them. These sources of consumption of water are manifestly entirely independent of the population of the city; but they bear a definite relation to the length of pipes.

The quantity of water used for public purposes cannot be accurately measured. No effort has ever been put forth in New York to determine the amount; but in a few American and a large number of foreign cities, particularly in Germany, very careful investigations have been made, which show the average quantity of water thus used to be not far from 5 gallons a day per head of the population. As before stated, this basis of computation in the case of such a city as New York does not appear to be reasonable; for the use of water for public purposes depends more upon the length of streets in which the water is used than on the number of people who reside in those streets and in other streets unsupplied with water. From a comparison of the various records obtainable, both in America and abroad, Mr. Croes thinks a fair basis of estimation of water used for public purposes is 15,000 gallons per mile of main.

For nearly twenty years the records of the quantity of water measured by meters were in charge of the Chief Engineer; and in his reports for each year from 1880 to 1891 there was published a very valuable analysis and classification of the character of the occupation of the premises to which meters were applied, and the quantity of water used per day by each of such consumers. The larger consumers were metered first; and, as the number of metered premises increased, the average consumption through each meter decreased until 1887, since which time it has been practically a constant quantity. After 1891, the Chief Engineer was relieved of the duty of making a classification of meter records; and they have not been made, except in 1894. The quantity of water passed by the meters since that date Mr. Croes has computed from the reports of the Water Registrar, which show the number of meters and the revenue derived from them each year. It appears from these records that the daily consumption of water per metered tap since 1888, when there were 17,750 meters in use, up to the present time, when there are 36,068, has averaged 1450 gallons.

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To check the records of the Water Department as to the consumption of water by private meters, a copy of the records of the monthly readings of 600 meters on buildings of various classes in the city for the past three years was procured from Mr. J. H. Bellis, who has been engaged on the monthly inspection of metered premises by the owners for the purpose of inspecting and checking useless waste of water. A careful analysis of the records furnished by him shows the following result:—

Year.	Number of Meters.	Number of Gallons per Day per Meter.
1897	580	1585
1898	584	1674
1899	574	1491

The quantity of water which passed through single meters of the 574 recorded in 1899 ranged from 64,885 gallons a day in a large manufacturing plant, to 17 gallons a day in a clothing store; but the average of all was 1491 gallons, as against the average derived from the Water Registrar's report of the revenue from 35,755 meters, which gave a consumption of 1417 gallons per meter.

With regard to water used for domestic and general purposes, it may be assumed that none of the metered water is wasted—at all events, it is accounted for, and it produces a revenue. Attempts have been made in New York to determine the proportion of the premises on which water is used in which a constant waste occurs. The difference between a liberal use of water for legitimate purposes and a parsimonious use is really very slight, on the whole. It is the constant loss of water from deliberate wastefulness or unknown defects in plumbing which causes the great difference found to exist in the consumption per house in cities where the majority of buildings are metered and those in which a few or none are furnished with these appliances. When it became evident in New York that the demand for water was increasing at such a rate that the supply would soon be exhausted, an effort to determine the proportion of buildings in which waste occurred, and to take steps to check such waste, was begun by Mr. Allan Campbell, who was then Commissioner of Public Works. In December, 1876, an inspection was made of all the houses in the city; and it was continued with more or less thoroughness for ten years by Mr. Campbell and his successor, Mr. Hubert O. Thompson. The result of the inspections made for nine years was as follows:—

Year.	Premises Inspected.	Premises on which Leaks were Found.
1877	106,577	15,718
1878	55,386	9,572
1879	46,307	8,845
1880	18,347	2,935
1881	19,392	2,122
1882	24,189	3,531
1883	15,308	1,770
1884	19,277	5,944
1885	47,590	5,231
Total	352,373	53,668

Leaks were found in only 15 per cent. of the premises inspected.

To determine the amount of water which ran to waste in buildings where leaks were found, inspections of the house drains leading to the sewers were made, from 1882 to 1884, with the following results:—

Year.	Drains Inspected.	Leaks Discovered.
1882	9,268	1411
1883	9,893	1623
1884	9,275	939
Total	28,436	3973

In this case, the leaks discovered amounted to 14 per cent. of the total number of drains inspected.

The quantity of water flowing out of the house drains about two o'clock in the morning was estimated in each case where it was found; and the aggregate, from the 3973 cases in which water was found running, was at the rate of 13,232,160 gallons per day, which made the average for each of the 28,436 houses examined a waste of 465 gallons per day. This was not a close gauging, but an estimate from inspection of the water running in the drain-pipes.

In Boston, during the last four years, an inspection of buildings has been carried on, with the following results:—

Year.	Houses Inspected.	Leaks Discovered.
1896	15,288	2,635
1897	47,778	7,652
1898	54,007	11,051
1899	52,425	13,440
Total	169,498	34,728

The proportion of premises on which leaks were discovered was 20·5 per cent. In 1899, it was 25 per cent. In this case, no effort seems to have been made to determine the amount of leakage from the several premises.

It would appear from these observations that in 75 to 85 per cent. of the premises on which water is used there is practically no leakage or excessive waste of water when a systematic inspection of buildings is carried on. Continued inspection reduces the proportion of the premises on which leaks exist, but does not check waste entirely, which cannot be accomplished without putting a meter on the service-pipe and requiring the consumer to pay for all the water that passes through it under all possible conditions.

The efforts towards restraining waste of water in domestic use have been confined to reducing the amount which is wilfully wasted, by placing meters on the services of business consumers, and making them pay by measure for their water. The placing of meters on private residences is not permitted by law, or, more properly speaking, the compelling of the private consumer to pay for a meter for the water which passes through it is not authorized by the City Charter.

For several years a considerable reduction of waste from unseen and not readily discovered sources, such as leaking fittings and main-pipes, was effected by reducing the head of water in the pipes. This did not,

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as is generally supposed, diminish the quantity a consumer could use legitimately, but it did lessen the loss by leakage, and so increased the amount available for actual use.

It was by a skilful application of the reduction of head that the supply of necessary water was kept up for the whole city during the years from 1883 to 1890, while the new aqueduct was being built. The gates at the reservoirs and the stopcocks in the mains were partly closed, so that just enough water would pass through them and into the several districts of different elevations to rise not higher than the first or the second storey of the houses. The deterioration of the pipes kept on increasing with little or no effort to stop it, and defective plumbing was not repaired except when it caused inconvenience to the occupant of the house. The increasing loss from invisible leaks was overcome by lowering the pressure on the pipes.

Then in July, 1890, the water from the new aqueduct was turned on, the throttled gates and stopcocks were opened, and the full pressure from the water in the reservoirs was turned on the pipes. The head on the mains increased from 20 to 25 feet; and the result was an immediate enormous increase in the consumption of water. In the first half of 1890, the consumption was about 105 million gallons a day; in 1891, 153 million gallons were used; and by 1895, the quantity had increased to 180 million gallons. Additional leading mains from the reservoir to the lower portions of the city were laid, and the increase during the next year was 20 million gallons a day. In 1897 and 1898, the laying of a line of large mains enabled the head of water in the lower part of the city to be increased still more; and the consumption advanced to 226 million gallons a day in 1898, and 246 millions in 1899. That this was not due to an increase in the actual quantity of water taken by consumers is shown by the fact that the water used by 25 per cent. of them was measured during the entire period from 1889 to 1899, and the rate was not materially, if at all, increased. There were 19,040 consumers taking water through meters in 1889; and the average use of water by them was 1428 gallons per day each. In 1899 there were 35,755 consumers taking water by meter; and they used 1417 gallons a day each. There is no reason to suppose that the average actual use of water by consumers of any class augmented materially during that period of ten years. The number of unmetered consumers rose about 40 per cent.; but the quantity of water furnished to them which disappeared somewhere increased 160 per cent. Dividing the total unmeasured water by the number of unmetered taps, the daily rate increased from 907 gallons a day in 1889 to 2248 gallons in 1899. It is not unreasonable to say that it was impossible that 75 per cent. of the water-takers doubled their use in about seven years, when it was proved that the remaining 25 per cent. taking water under the same conditions, except as to measurement of the supply, did not appreciably increase their use of water. If the higher pressure had increased the legitimate employment of water in the metered buildings, it would have shown in the records of the measured supply. That it did not do so, but merely increased the waste from orifices either undiscovered or left open by design, is clearly established by the fact that where such orifices did not exist the use of water did not increase.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A discussion took place in the Dundee Town Council this week upon the quality of the coal supplied to the gas-works, in which, to my mind, expressions were used which were decidedly strong. It was originated by Mr. High, who said the report of the Analyst showed that in three of their contracts the quality of the coal was about 3-candle power less than that contracted for. They had a loss on each ton of 2s. 8¾d.; and the loss for the month on the 6000 tons supplied was about £53. The Gas Commissioners carbonized about 66,000 tons of coal; and this represented a loss of £600 a year. The quality of the coal was not nearly so bad as during the previous month. He suggested that the contractors should implement their bargain; and, failing this, the contract should be at once stopped, and the Commission should buy in the open market against the defaulting contractors. He thought it was very unfair to other offerers to accept coal of 16-candle power when they contracted for coal of 19-candle power. Mr. Quirk asked the Clerk who were the contractors who had not been supplying coal up to the standard. Sir Thomas Thornton said he did not think names should be given in public, lest an action for damages might be raised against the Council. They were not entitled to publish the names of parties unless they were satisfied their statement against them was correct. Bailie Barrie moved that, if the coals were not up to contract in future, no more notice be given to contractors, but that coals be bought against them in the open market. Mr. Henderson seconded, remarking that it was astonishing that for all these years the Gas Commissioners had been allowing themselves to be taken advantage of. Ex-Provost Brownlee suggested that the defaulting contractors be struck off the list. Bailie Barrie's motion was unanimously agreed to, as was ex-Provost Brownlee's recommendation. Bailie Stevenson said it had to be remembered that again and again their Analyst had reported to them that they had got a better quality of coal than had been contracted for. This latter remark is, at best, only an extenuating circumstance. Any deficiency in quality is not necessarily wiped out by the fact that sometimes the quality was over the standard. I think that Mr. High did not go beyond his province in stating his case. But I take exception, as the Town Clerk did, to the proposal to publish the names of the contractors complained of; to Mr. Henderson's assumption that the Council had been allowing themselves to be taken advantage of for years; and to the proposal (which was agreed to) to strike defaulters off the list of contractors.

The Corporation of Aberdeen, on Monday, considered a report by the Gas Committee upon the demands of the gas-works employees, which I gave last week. Mr. Kemp, the Convener, said the Committee had every desire to look at the situation in a reasonable way; but they considered the demand was unreasonable. The men were emphatic in that they must have their whole demands; and as the Committee could not face this, they recommended that they be declined altogether. The increases of wages asked for would amount, in some cases, to 7s. a week. They had in the gas-works 73 men who had been in their employ for periods ranging

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from 10 to 48 years, and they had winter men who had been coming back to them for from 15 to 35 years; so it did not appear that they had been working the men like slaves. No better proof could be obtained of the men's own opinion of, and satisfaction with, the conditions of labour in the gas-works. Every morning they had a crowd of men at the gas-works gate, asking to be taken on—artisans of all classes, men capable of earning high rates of pay, willing to work as labourers, and pleading to be employed. There was seldom a week in which he was not waited upon by about a dozen men, asking to be taken on at the gas-works. In the face of all this, the Committee felt that the application was most inopportune, and that it would be unfair to the gas consumers to grant the demands of the men. That the matter be referred back to the Committee, with instructions almost that they grant the men's demands, was moved by Mr. Johnston, the former Convener of the Committee, who, as I have pointed out before, seems to be unable to see any good in the work of his successor. Mr. Johnston is a labour leader. Another who rose from the ranks of labour is Treasurer Bisset. He supported the Committee, upon the ground, among others, that if the Council had money to spare upon labour, he would prefer, instead of giving it to the select few inside the gas-works, to give it to those who were outside, and who could get nothing to do. On a vote, only 4 agreed with Mr. Johnston, and 23 supported Mr. Kemp. The recommendation of the Committee was thus adopted. In the course of the discussion, Mr. Boddie (a particular friend of mine) made use of an expression which was interpreted to mean that the application of the men was a "put-up job." This gave rise to much bitter comment by those who favoured the men. How does the matter stand? On the resolution of the Council becoming known, the officials of the Union telegraphed to Glasgow asking Mr. Blackwood, the Secretary of the Scottish Branch of the Union, to come to Aberdeen at once, as the men did not intend to take further steps with regard to the wages dispute till they had directions from headquarters. So it is said; but the other view is open—and, indeed, is the more feasible—that the officials of the Union wanted Mr. Blackwood in order that he might assist them in keeping the "pot boiling." Mr. Blackwood arrived in Aberdeen on Thursday, and addressed a meeting in the evening. No definite course of action was decided on; but it was resolved to hold a meeting the next day, at which, it was said, "the men would arrange what further steps would be taken in the matter." This meeting was held yesterday; and at it a deputation was appointed to wait on the Gas Committee and lay their demands before them. It is not, it is said, the wish of the men to strike; but they desire that some concessions should be granted. I think that this looks very much like a business engineered from the outside, and that it has collapsed.

While this has been going on in Aberdeen, it is stated that, on account of a recent strike at the Phœnix Tube-Works in Glasgow having been authorized by the Scottish Branch of the same Union, Mr. Blackwood has been asked to resign his post; and that he is about to proceed to London to endeavour to vindicate his position before the Executive of the Union. Mr. Blackwood seems to be in a tight place. If it be the case that he has been asked to resign, the incident shows, once more, there are no greater tyrants in the shape of employers than Trades Unionists.

It has taken a long time to reach the point when any except a few could form an opinion as to the best site for the new Corporation gas-works at Falkirk. There are two sites proposed—one at Parkhouse, where the wire-rope guided gasholder is; and the other at Thornhill, to the north of the burgh. There have been muttered objections to the Parkhouse site, on the grounds that it would give bad foundations for buildings, and that it was too small. The latter did not appear to be an insuperable obstacle—particularly when placed against the fact that the Corporation, before the erection of the gasholder some years ago, purchased the ground. It looked unbusinesslike to purchase a second site, unless there were some good cause for doing so. The nature of the site might be a good reason; but its nature was not known to many, until this week. The publication of it should at once put an end to any attempt to have the new gas-works erected at Parkhouse. Where there is, in some places, soft sand and moss going down to a depth of 8 or 9 feet, and below that, as far as a depth of 20 feet, there is only sand and gravel, it is manifest that to build a gas works there would entail an extra cost which would go far to procure another site. This leaves out of account the continual outlays upon upkeep which would be necessary in such a place, and which, when taken into account, would make the Parkhouse site the more costly of the two. It must have been a misapplied intelligence which advised the purchase of the land at Parkhouse. I can conceive a reason why there should have been hesitation to publish the results of bores of the site, because the knowledge of the nature of the ground will make it difficult for the Corporation to re-sell it, should they so desire. But if this were so, they must be unreasonable men who would not have accepted the information in a private way, and so prevented the exposure of the weakness of the site. The reports as to the nature of the ground at Thornhill were altogether satisfactory. These reports were obtained by the Commissioners in November, 1899, and January, 1900; and the Commissioners have also had before them since November, 1899, a joint report by Mr. J. M'Gilchrist, of Dumbarton, and Mr. J. Kincaid, the Manager at Falkirk, upon the question, in which they condemned the Parkhouse site, and expressed their approval of the Thornhill or another site, should the bores prove satisfactory. According to them, in addition to the other drawbacks to the Parkhouse site, if the works were planted there it would require a sum of £3000 to satisfactorily couple them up with the town mains. How, with this information accessible, there should have been any desire to see the Parkhouse site adopted, I cannot understand. The publication of the reports of the Engineers and of the borers should soon put an end to all delays, and allow the new works to be gone on with at Thornhill. At a meeting of the Commissioners on Monday, a discussion took place upon the pressure of the gas supplied; and the explanation given was that it was not so much that the works could not produce gas, as that the purifying plant was not sufficient. In such a matter as this, of course, nothing can be done, as there is no rough-and-ready method of extemporizing purifier plant; and the general conclusion which was come to was that the sooner the new gas-works were gone on with the better.

Another attempt to deal with the question of the opening of streets

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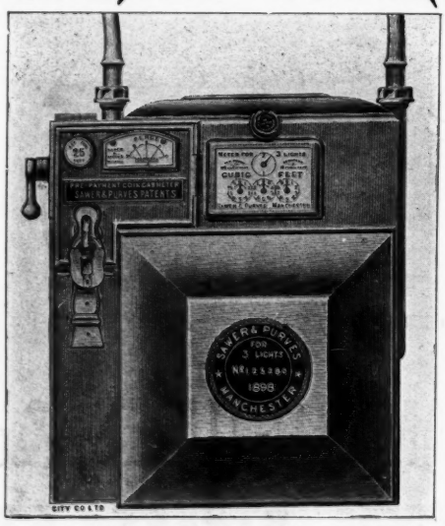

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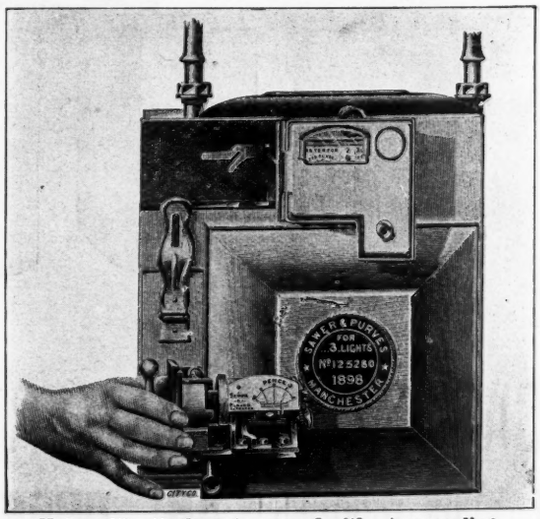

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falls to be recorded. This time it was in Glasgow. The mover was Bailie D. M. Stevenson, whose proposal was that the heads of the Gas, Water, and Electricity Departments, as also the Master of Works, be directed to prepare and submit to the Corporation a return showing the cost of opening and restoring the streets for public purposes within the last ten years—differentiating, as far as possible, between the actual cost of opening and closing, and that of lifting and relaying pipes or other conveniences. This was submitted to the Corporation on Thursday. A discussion followed upon it, in which it was pointed out that such a return would entail enormous labour on the officials, and in the end would be of no value. Bailie Stevenson then accepted a motion to the effect that the subject be remitted to the various Committees for consideration; and this was adopted by a majority of one, as against the previous question. I fear the remit will be the last of the movement. The opening of streets in towns is one of those things which, like muddy roads in the country, although a great inconvenience, must be endured.

A memorandum on the proposal of the Corporation of Glasgow to assess landlords and tenants equally for the lighting of common stairs has been prepared by the Directors of the Glasgow Landlords' Association. In this document, it is pointed out that the proposal amounts to saddling the owners with an annual payment of at least £36,000, as against £3500 at present; and while apparently relieving the tenant of one-half of the £71,000 odd which he presently pays, yet, as the money will almost certainly be spent in other directions, in reality imposing an additional new tax upon him also. It proceeds to argue that, as such lighting ought not to fall upon the landlords, the proposal is to revolutionize the law of taxation. The memorialists intend to oppose the passing of the proposed Provisional Order.

The difficulty about the lighting of Cowdenbeath still continues. A meeting was held between representatives of the old Gas Company and of the proposed new Company, at which the former stipulated that they get £500 stock of the new Company for their plant. This was refused; and subsequently the Secretary to the new Company wrote to the Secretary to the old Company offering £200 if the old Company would consent to stand aside, but not as a purchase-price. This offer is under consideration; but in the meantime, a third Company have started, who, it is said, have made an offer to the Burgh Commissioners, which is being considered by the Commissioners.

Mr. A. Wilson, Manager of the Dawsholm Gas-Works of the Glasgow Corporation, writes (under date of the 6th inst.): "Permit me to call your attention to the paragraph in your 'Notes from Scotland' of this week, relating to testing of incandescent burners, &c., at Dawsholm, and to say there is no truth in the report."

The shipment of tar from Archangel rose from 63,783 barrels in 1898 to 89,310 in 1899, while that of pitch fell from 15,742 to 12,461 barrels. The weight of last year's export of both articles is given as 699,251 poods (about 11,278 tons), and the value as 399,447 roubles (£42,047). This once flourishing branch of Archangel trade is fast declining.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 8.

Sulphate of Ammonia.—Again the week opened with a quiet market, and prices declined about 1s. 3d. per ton. But later there was a recovery; and the closing quotations are £10 13s. 9d. to £10 17s. 6d. per ton, delivered f.o.b. at the ports. Scotland has been the best market, there being considerable requirements to be covered, and the improvement elsewhere has been mainly consequent upon this. Shipments during November, however, show a considerable decline as compared with those for November, 1899; but supplies do not appear too plentiful, although all production seems to be offered everywhere as it becomes available. There continues to be large inquiry for the spring months; but makers stick to their quotation of £11 7s. 6d. per ton, and speculators appear nervous about selling short. On the other hand, buyers will not pay the premium required; and their purchasing has consequently been mainly for January delivery, at £11 to £11 2s. 6d. per ton.

Nitrate of Soda is firm at 8s. 3d. to 8s. 6d. per cwt., according to quality, on spot. Ahead, there has not been much doing; but on the part of holders there is no disposition to give way.

LONDON, *Dec.* 8.

Tar Products.—The position and prospects of business, generally speaking, is unsatisfactory. Creosote is quoted lower, and difficult to place. Pitch is also quoted lower, although very little new business is being done at the decreased values mentioned; makers being largely sold. Benzol is moderately steady; but the advance in price which was expected has not come so far. Anthracene continues unsaleable; and lower prices are being paid for tar contracts.

Quotations during the week are: Tar, 15s. to 20s. Pitch, east coast, 33s. 6d.; west coast, 30s. Benzol, 90's, 10d. to 1s.; 50's, 1s. 1d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Crude naphtha, 5d. Heavy naphtha, 1s. Creosote, 1½d. Heavy oils, 2¾d. Carbolic acid, 60's, 2s. 6d. Naphthalene, 90s.; salts, 50s. to 70s. Anthracene, nominal, "A," 3½d.; "B," 2d.

Sulphate of Ammonia shows no change; but stocks and production are well taken up. The average value in all positions is about £10 15s. per ton, less 3½ per cent.

Half the members who were present at the last meeting of the Pickering District Council (four out of eight) are shareholders in the local Gas and Water Company; and this led to some difficulty when Mr. Thomas Frank introduced the question as to whether the Council should approach the Company, with a view to purchasing their works. The Clerk told Mr. Frank that, being a shareholder, he was not entitled to vote on the matter. Mr. R. W. Frank (a nephew) said he did not want to throw cold water on the proposal; but he understood that the Company were not inclined to sell. Being asked to move a resolution, Mr. R. W. Frank said: Well, as my uncle is interested and cannot vote, I move that we approach the Company, to ascertain if they will sell the undertaking. There was, however, no seconder to the resolution; but it is likely to be brought forward again at a later meeting of the Council.

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COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although a great deal of caution is just now being shown by large users with reference to entering into forward contracts of any weight, and there is a very considerable business of this description at present being held in abeyance, a generally steady position is being maintained throughout the coal trade of this district. Collieries are not at all pressing sellers, nor disposed to offer any very material concession upon current rates for forward deliveries. The general impression, however, is that prices have touched the top; and among large users there is a disposition to go on buying from hand to mouth, rather than contract over any extended period at the prices coalowners are asking. In the better qualities, there is not more than a moderate business doing for house-fire purposes; but nothing of any weight is going down into stock. Prices are exceedingly firm at the full list basis of 16s. 6d. to 17s. 6d. per ton at the pit for best Wigan Arley, 15s. to 15s. 6d. for Pemberton four-feet and seconds Arley, and 14s. to 14s. 6d. for common house coal. Common round coals, notwithstanding the undoubted great depression throughout the iron trade, are still moving away fairly well for steam and forge purposes; and supplies are not at all excessive upon the market. From 12s. 6d. to 13s. per ton at the pit remain about the average figures. Of engine fuel, supplies continue plentiful from outside districts; but local collieries have no surplus output that they are pushing for sale, and are firm in holding to 10s. to 10s 6d. per ton at the pit as their quoted rates for the better descriptions of slack. Negotiations are, however, going on for one or two very important contracts for next year, at a substantial reduction upon current rates. Shipping remains quiet; and it is only in exceptional cases where more than about 15s. 3d. to 15s. 6d. per ton is being obtained for steam coal, delivered at the ports on the Mersey. Furnace cokes continue weak, and can be bought at about 14s. to 15s. at the ovens. Foundry qualities remain at an average of 28s. to 30s. at the ovens.

Northern Coal Trade.—The coal trade has shown a slight further falling off this week; and the tendency is still towards ease, though at the lower prices rather more orders are coming into the market. The open weather, however, limits the consumption of coals in several ways. Best Northumbrian steam coals are quoted at from 14s. 6d. to 15s. per ton f.o.b.; second-class steams are about 9d. lower; and steam smalls are from 7s. 9d. to 8s. The collieries have so far full work; but there is a difficulty in obtaining forward orders, unless at some concession in price. In gas coal, the deliveries are now at about the highest point of the year; but the supply is abundant, and there is therefore a rather lower price quoted for occasional cargoes—from 13s. 6d. to 14s. per ton f.o.b, for best Durham gas coals. Best Durham coke is 21s. to 23s. per ton f.o.b.; and blast-furnace coke is down to £1 per ton, at the Teesside furnaces. The price of gas coke shows no change; but in a short time new contracts for next year will more exactly determine the values. The present large output is fairly well taken up.

Scotch Coal Trade.—The old complaint about the scarcity of railway waggons is being put forward to account for broken time at some collieries. When railway waggons get scarce, the reason is not that the Railway Companies restrict the supply, but that the coalowners fill them and cannot get them emptied. That is the case now. The demand has eased off so much that coal is getting plentiful. More ominous still is the fact that ironmasters are shutting down their furnaces. Coal has, since October, come down in price from 4s. to 5s. per ton. The rates quoted are: Main 13s. to 13s. 3d. per ton f.o.b. Glasgow, ell 13s. 6d. to 14s. 6d., and splint 14s. to 14s. 6d. The shipments for the week amounted to 183,202 tons—a decrease of 16,082 tons upon the previous week, and of 20,064 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,082,480 tons—an increase of 978,442 tons upon the same period of last year.

Additional Water Supply for Keswick.—On Monday last week, the first turf was cut in the Fitz Park, Keswick, in connection with the additional water scheme promoted by the Urban District Council. In the presence of the members and officials of the Council and friends, the ceremony was performed by Miss Philipson, daughter of the Chairman, Mr. William Philipson. The scheme will provide an ample supply for the district, and ensure a service being laid to the higher elevations in the added area.

Carlisle Gas Committee Decide on Water Gas.—The Gas Committee of the Carlisle Corporation held their monthly meeting last Wednesday, Mr. Coulthard, in the absence of Mr. Corbett, presiding The question of the proposed gas-works extensions was considered, and a motion was submitted by Mr. Scott in favour of an installation on the present site of carburetted water-gas plant to produce 600,000 cubic feet of gas per day, as suggested by Mr. Corbet Woodall (*ante*, p. 965). On being put to the meeting the voting was even. The Chairman then gave his casting vote for the motion, and declared it carried. A suggestion was made in the course of the discussion which took place that plant to manufacture 300,000 cubic feet of carburetted water gas per day would be sufficient. No proposal was made for the removal of the gas-works to Kingmoor, or for the adoption of any large scheme of coal-gas manufacture at the present time.

Welsbach Lighting in St. Andrew's Cathedral, Singapore.—The following paragraph appeared in the "Straits Times" for the 15th ult., which reached us yesterday: "Reference was made at St. Andrew's Cathedral last Sunday evening by the Rev. D. Holland-Stubbs, at the close of the sermon, to the debt outstanding for the cost of re-lighting the cathedral; and an appeal was made for funds to pay off the small balance. We understand the estimate for the new Welsbach light amounted to $1550, all of which has now been raised by donations and offertories. The new light is a decided improvement upon the old system—in fact, everything that could be desired—and we hear that the cost per month for maintenance, gas, and mantles, is only a trifle over one-third of the cost of the former light; so that while the light has been materially increased, the expenses have been considerably reduced. By a strange coincidence, the hymn at the close was 'Hail! Gladdening Light.' It raised quite an audible smile."

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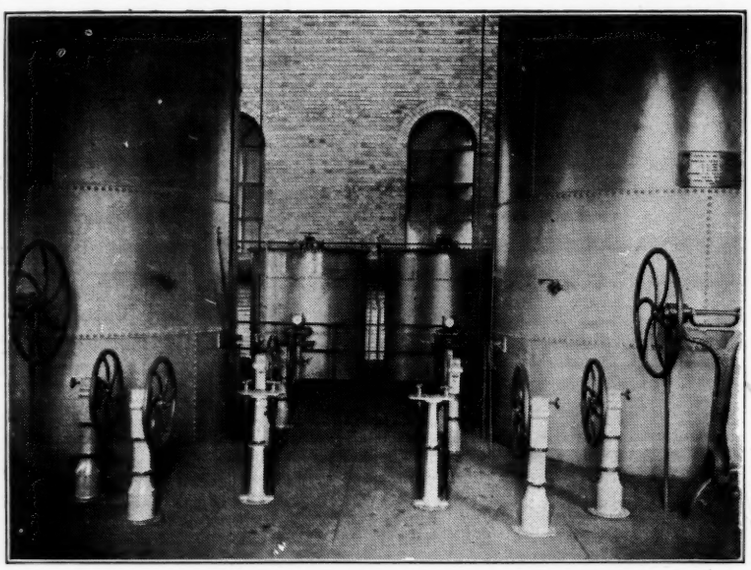

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Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
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Opposition to the Mond Gas Scheme.—At the meeting of the Oldbury District Council last Friday, the Clerk (Mr. W. Shakespeare) reported that he had received notice from the Mond Gas Company of their intention to apply to Parliament for power to supply gas within certain areas, which included a number of boroughs and urban districts. The Company, he explained, were asking for power to acquire 30 acres of land at Smethwick for the purpose of erecting works for the manufacture of gas from rubbish and other waste materials; and, if established, the Company would compete with the gas undertaking of the Council and also with their electric lighting scheme. It was decided to oppose the Bill; and the Clerk was instructed to take the necessary proceedings.

Newport (I. W.) Water Supply.—At the meeting of the Newport (Isle of Wight) Town Council last Tuesday, the Water Committee reported that Mr. E. T. Hildred had discussed with them the question of the construction of a new reservoir, and the supply and laying of mains, &c. He favoured the erection of a reservoir first, and the laying of the mains, &c., subsequently, as opportunity afforded. Mr. Hildred was prepared to get out the quantities for the reservoir at 2 per cent., and for the mains free of cost. The Committee recommended that tenders be invited for the construction of the reservoir, that Mr. Hildred be employed to get out quantities on the terms mentioned, and that he give no order for work outside the contract exceeding £50 without consulting the Council. The Chairman of the Committee (Mr. Rich) moved the adoption of the report, and dwelt upon the existing need for the reservoir. Mr. Salter opposed the proposition, and moved, as an amendment, that Mr. Hildred be asked to prepare plans for a reservoir of 400,000 gallons capacity only. A discussion ensued; but, in the end, the amendment was supported by the mover only, and the motion was carried.

Progress of the Birmingham Corporation Water Scheme.—At the meeting of the Birmingham City Council last Tuesday, Alderman Lawley Parker brought up the report of the Water Committee already noticed (*ante*, p. 1411), and in moving its approval said that during the half year ending in September about half-a-million gallons less water per day had been used than in the corresponding period of last year. They might congratulate themselves on having got through the summer extremely well—very much better, in fact, than in the years 1898 and 1899, although there was an estimated increase in the population of something like 20,000 a year, and 5000 houses had been built during each year. It was to be hoped the remaining years would be equally favourable in respect to the weather and the forbearance and consideration shown by the ratepayers in not wasting the water. He reviewed the progress which had been made in the Elan Valley portion of the scheme since the visit of the Council in June, and said that in regard to the laying of the mains from Frankley to the city a good deal of work remained to be done; but it would be systematically and quickly accomplished, so as to interfere with the convenience of the inhabitants as little as possible. The report was approved.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards sold, by order of the Directors, £5000 of new ordinary stock of the Southend Gas Company, ranking for a standard dividend of 5 per cent., the last declared on similar stock having been at the rate of 5½ per cent. per annum. It was put up in 50 lots, and was disposed of as follows: 5 at £105 10s., 36 at £106, 4 at £106 10s., and 5 at £107. A new issue of £10 "B" shares in the Crays Gas Company (last dividend £4 18s. per cent.) was placed at prices ranging from £10 to £10 10s. per share. Some original £10 "A" shares in the Harrow and Stanmore Gas Company (last dividend 8 per cent.) fetched £14 15s. each; and a few £10 fully-paid 6 per cent. guaranteed shares, £14 10s. apiece, *cum div.* On the same day, Mr. W. E. R. Randall disposed of several "B" (10 per cent.) shares of £10 each in the Sheppey Gas Company at £20 10s. each; and two "C" (7 per cent.) shares, of like nominal value, at £15 per share. On Wednesday, Mr. Frank Amos submitted £2500 new "A" and "B" stock of the Canterbury Gas and Water Company, for sale in £10 lots. Thirteen of them fetched £22 each, and the rest £21 15s. and £21 10s. apiece. On Monday last week, Mr. Henry Escritt sold £4000 of new consolidated ordinary 5 per cent. stock of the Grantham Gas Company in £1 lots, which fetched 23s. each. Messrs. Griffiths and Chennell have lately disposed of £450 of consolidated stock of the Newmarket Gas Company (last dividend 6½ per cent.) at from £81 to £82 per £50 lot. Last Tuesday, Mr. J. H. Cooper, jun., sold some 6 per cent. preference shares of £20 each in the Gravesend and Milton Water-Works Company at from £35 to £35 10s. each.

Village Water Supplies and Water-Rates.—Local Government Board inquiries were held last week at two places in the St. Germans Union to determine the reasonable cost of furnishing a supply of water to houses in the villages. The first was at Millbrook, a village largely occupied by workmen at the Devonport Dockyard. It was stated that about half the houses used water from the public supply, and the Rural District Council proposed that these should be charged a rate equal to 7½ per cent. on the rateable value. The proposal was resisted by the Parish Council, who contended that the supply was insufficient owing partly to the defective state of the reservoir, which one of the witnesses described as like a bird-cage. Many of the villagers who now took the public supply would, it was asserted, cut the water off if a rate were charged. The second inquiry was in respect to the rate to be charged for the supply to houses at Downderry, a little holiday resort on the south coast of Cornwall. The rateable value of the houses in the village is only £742 per annum; while the cost of the water supply, which has been provided by the St. Germans District Council, is expected to reach £2000. The Council suggested that the charge to houses in the village should be 7½ or 10 per cent. of the rateable value. A charge of 7½ per cent. upon the whole of the houses would yield £55 per annum, while the interest and sinking fund on the loan would amount to £100. Mr. E. P. Burd said the Local Government Board expected that people should pay for water just as they paid for bread. It was explained that the District Council thought the village would grow, and they did not want to prevent this growth by excessive rates. Complaint was made by ratepayers in St. Germans village that the supply to that part of the district was wholly inadequate. They had no objection to help Downderry if their own wants received attention. The Inspector said this was a matter for the Council, but formal complaint could be made to the Local Government Board.

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Southwark and Vauxhall Water Company.—The report of the Directors for the six months ending Sept. 30 states that the number of new domestic supplies taken into charge during the half year was 828, estimated to produce an increased annual rental from this source alone of £1780. In addition, the income derived from meter supplies and other sources shows a satisfactory increase on the corresponding period of past years. The Directors recommend the declaration of a dividend at the rate of 5 per cent. per annum on the preference stock, and 7 per cent. per annum on the ordinary stock and class "D" shares of the Company.

The buildings and plant of the Bervie Gas Company were sold by auction last Wednesday at the upset price of £150.

The Workington Corporation have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for twelve beds, consisting of 96 retorts, with regenerative furnaces and ironwork complete.

The arbitration between the Glastonbury Corporation and the Gas Company on the price to be paid for the undertaking of the latter has been postponed till next month, and consequently the transfer will not take place till March.

The Gas and General Illuminating Exhibition which Mr. T. G. S. Hersey has organized at the Drill Hall, Bristol (see *ante*, p. 1290) has proved so successful that, instead of closing on the 6th inst., as originally intended, it will remain open till the 8th prox.

The electric lighting and tramways undertakings of the Cardiff Corporation have been combined, and placed under the supervision of Mr. Arthur Ellis, the Tramway Engineer to the Corporation. Mr. Appelbee, the Electrical Engineer, is leaving Cardiff.

In view of the report that their Electrical Engineer (Mr. W. A. Chamen) had been offered by one of the largest electricity supply companies in London a position as Chief Engineer, at a salary of £1250 per annum, with a share of the profits of the undertaking, the Glasgow Corporation have increased his salary to £1000 a year from Jan. 1.

The Gravesend and Northfleet Tradesmen's Association strongly object to the paragraph in the notice for the Gravesend and Milton Gas Company's Bill by which it is proposed to alter the illuminating power of the gas from 16 to 14 candles; and at a large meeting last Thursday, the members of the Association decided to request the Town Council to oppose the clause.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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[For Illustrated Advertisement, see Dec. 4, p. 1426.]

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RETORT IRONWORK, MODERN HYDRAULICS.
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CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the Leeds City Council are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.

Specification and Form of Tender may be obtained on application to the undersigned.

Tenders, endorsed "Fire Goods," and addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Thursday, the 20th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. TOWNSLEY,
General Manager.

Municipal Buildings, Leeds,
Dec. 7, 1900.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that it is the intention of the Directors of the above-named Company, to OFFER FOR SALE BY AUCTION, at the Mart, Tokenhouse Yard, in the City of London, on Tuesday, the 8th day of January, 1901, at Two o'clock in the Afternoon precisely, £10,000 (Ten Thousand Pounds) of FOUR-PER-CENT. PERPETUAL DEBENTURE STOCK, being a portion of the amount authorized to be raised by the issue of Debenture Stock in accordance with Resolution passed at an Extraordinary General Meeting of the Proprietors held on the 24th day of February, 1900, in pursuance of the powers of the Tottenham and Edmonton Gas Act, 1898.

Printed Particulars, and Conditions of Sale, may be had at the Office of the Company, also of the Auctioneer, Mr. Alfred Richards, 18, Finsbury Circus, London, E.C.

By order,
JAMES RANDALL,
Secretary.

Offices of the Company,
Willoughby Lane, Tottenham,
Dec. 7, 1900.

BARNOLDSWICK URBAN DISTRICT COUNCIL.

TENDERS are invited for the supply of 3-inch and 4-inch CAST-IRON SPIGOT and SOCKET PIPES and SPECIALS (coated), delivered at Barnoldswick Station (Midland Railway).

Tenders to be sent in on or before Dec. 18.

D. E. GARLICK,
Manager.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Ironfounders, Gun-Barrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to the 31st of December, 1901.

Samples of Goods required are open to inspection on the Works, Great Brunswick Street; and Printed Lists of Articles required can be had on application at the Company's Offices, D'Olier Street.

Tenders, endorsed "Tender for Stores," to be lodged in my Office on or before the 27th inst.

FRANCIS T. COTTON,
Secretary.

D'Olier Street, Dublin,
Dec. 7, 1900.

BOROUGH OF LEIGH.
(GAS DEPARTMENT.)

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the carrying out of various WORKS in connection with the Erection of a Set of Six 30 feet square PURIFIERS, including VALVES and CONNECTIONS, &c.

Plans and Copies of Specification, with Terms and Conditions of Tender, may be obtained at the Office of the Engineer, Mr. John Foster, Gas-Works, Leigh, Lancashire, on and after Friday, the 30th day of November, 1900, on the payment of Three Guineas, which sum will be returned on receipt of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Tender for Purifying Plant," must be addressed to me at the Town Hall, Leigh, Lancs., and delivered on or before Twelve o'clock noon, on Monday, the 17th day of December, 1900.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
PEREGRINE THOMAS,
Town Clerk.

Town Hall, Leigh, Lancs.,
Nov. 26, 1900.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GAS-WORKS PLANT AND MACHINERY.

THE Commissioners are prepared to receive TENDERS for the supply of all or any of the following PLANT and APPLIANCES, delivered and erected at their Granton Works, from Contractors experienced in the construction of same. The whole of the Work is to be carried out in conformity with the General Conditions and Clauses of the Commissioners' Specification, and is to be delivered and completed and put to work on or before the 31st of March, 1902.

1. STEAM BOILERS AND FITTINGS of either the Lancashire or Tubular Type.
2. GAS EXHAUSTERS and ENGINES.
3. WATER-TUBE CONDENSERS for Steam.
4. WATER-TUBE CONDENSERS for Gas.
5. PELOUZE & AUDOUIN TAR SEPARATOR.
6. HYDRAULIC PUMPING MACHINERY, ACCUMULATORS, and CAPSTANS.
7. WASHER-SCRUBBERS of the Rotary Type for Coal Gas.
8. WASHER-SCRUBBERS and APPLIANCES for the Extraction of Cyanide Compounds.
9. PURIFYING PLANT.
10. PURIFYING PLANT HOUSE (Iron Structure).
11. STATION METERS.

Specification and Form of Tender may be obtained on application to Mr. W. R. Herring, Chief Engineer and Manager, Gas-Works, New Street, Edinburgh.

Tenders are to be delivered to the undersigned at or before Ten a.m., on the 11th day of February, 1901, sealed and endorsed, as directed under each portion of the Plant.

The Commissioners do not bind themselves to accept the lowest or any Offer.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
Nov. 30, 1900.

WEST MIDDLESEX WATER-WORKS COMPANY.

ISSUE OF £100,000 THREE POUNDS PER CENT. DEBENTURE STOCK.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above ISSUE, being a further portion of the £690,000 DEBENTURE STOCK created under the West Middlesex Water-Works Acts, 1894 and 1899, bearing Interest at 3 per cent. per annum, and redeemable after the expiration of 25 years from the date of issue, subject to Six Months' Notice being given by the Company.

Tenders must be delivered at the Company's Office, No. 19, Marylebone Road, N.W., not later than Eleven a.m. on Tuesday, the 18th of December next.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Office, or will be forwarded on application.

By order of the Board of Directors,
F. H. WYBROO,
Chief Clerk and Secretary.

No. 19, Marylebone Road, N.W.,
Nov. 20, 1900.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

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Now Ready. Net Price: Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.

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Illuminating Power . .	16·9	Candles.
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Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by
Mr. JOHN PATTINSON, F.I.C., F.C.S.

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Analysis made by
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Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

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GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16$\frac{7}{10}$ Stand. Sperm Candl.
Coke (of good & pure quality)	13$\frac{3}{4}$ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

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Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

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Yield of Gas per ton	10,500 cub. ft.
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Yield of Gas per ton	10,500 cub. ft.
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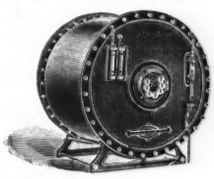

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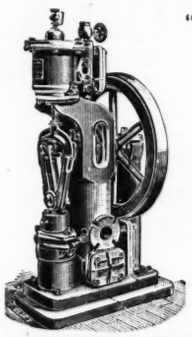

Fig. 705. "SINGLE RAM" STEAM-PUMP.

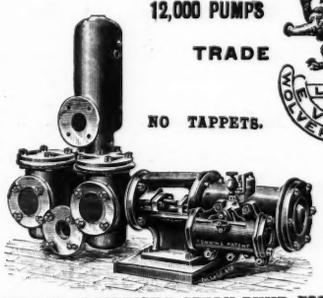

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

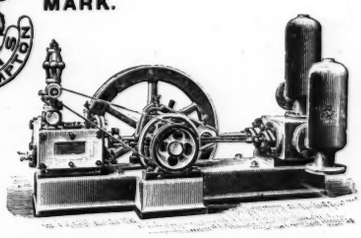

Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

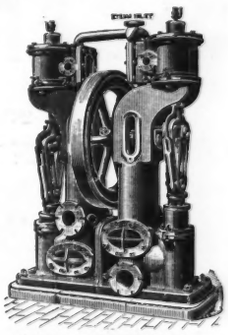

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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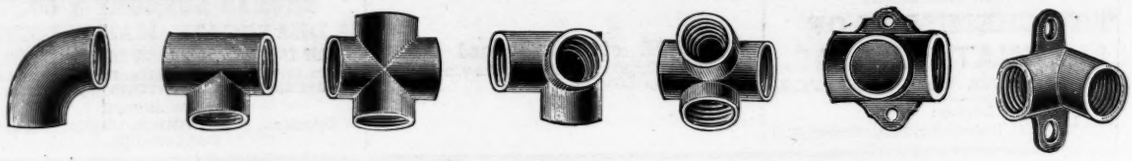

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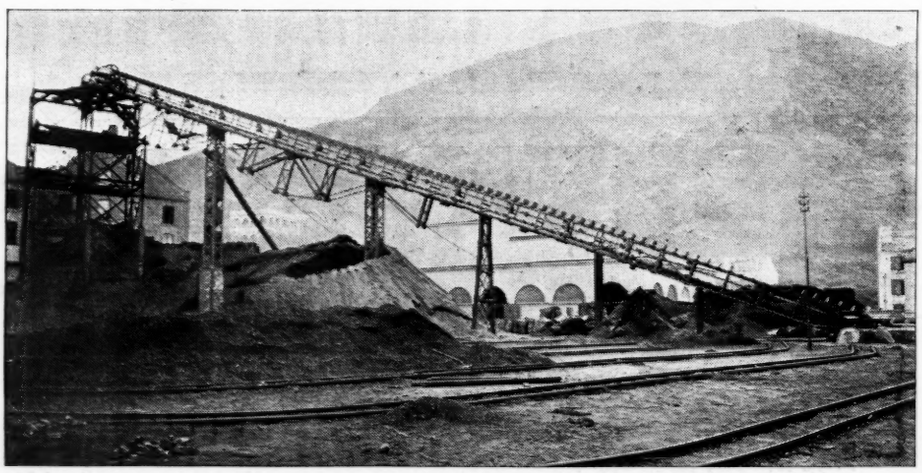

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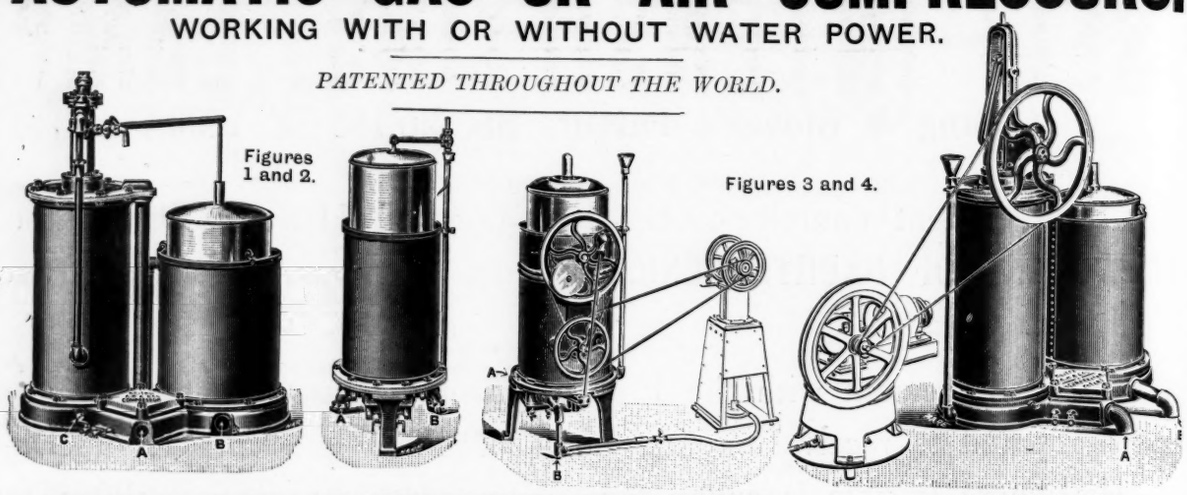

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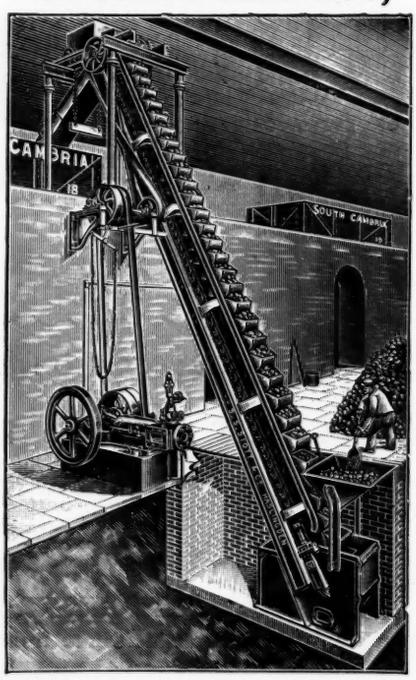

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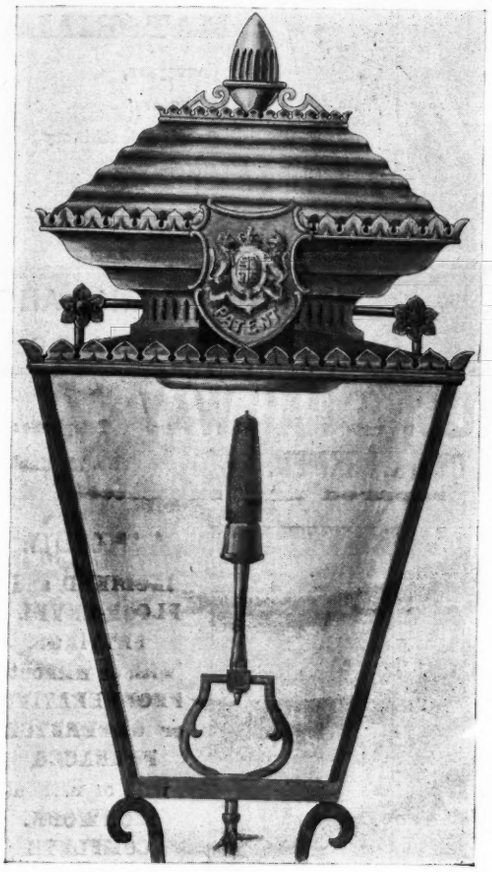

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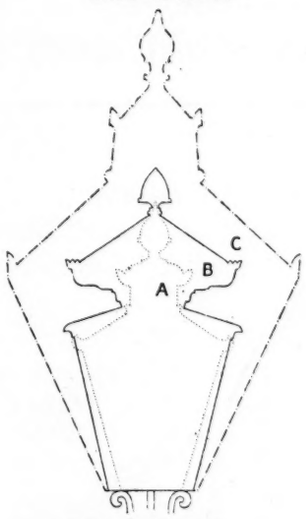

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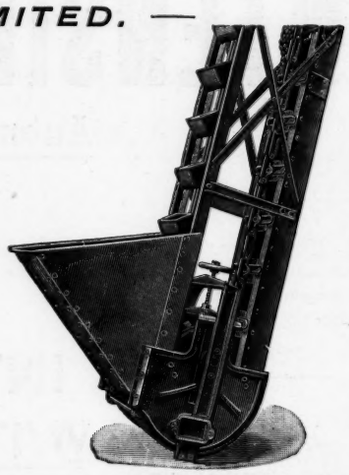

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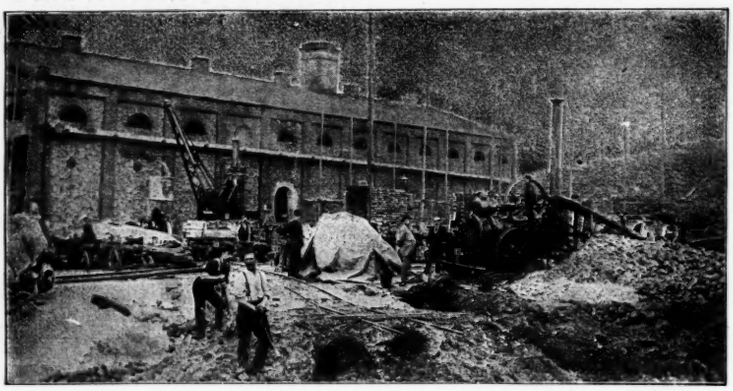

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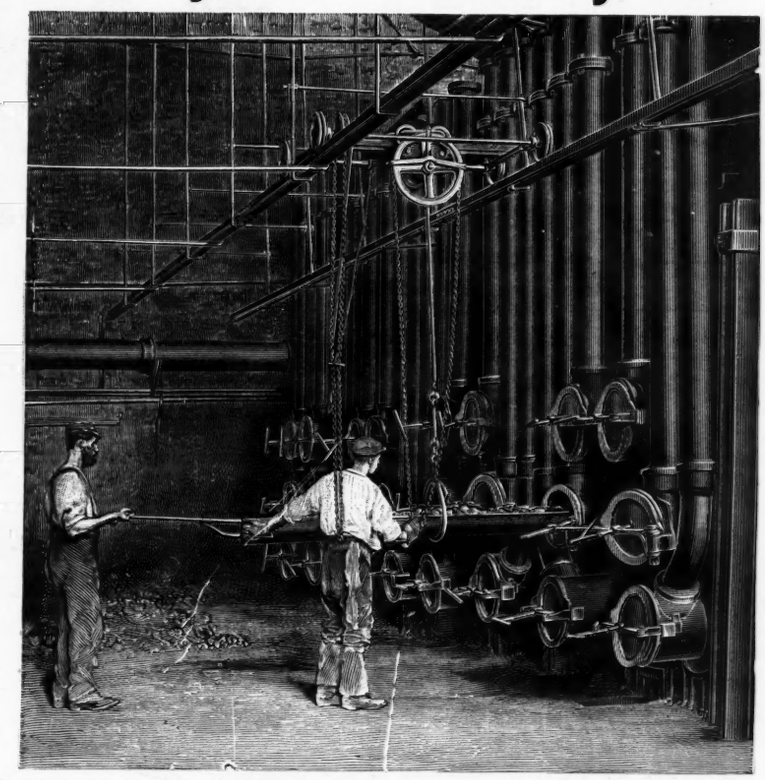

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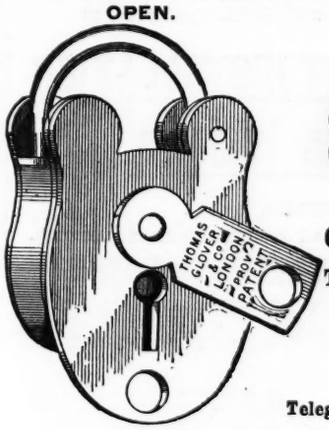

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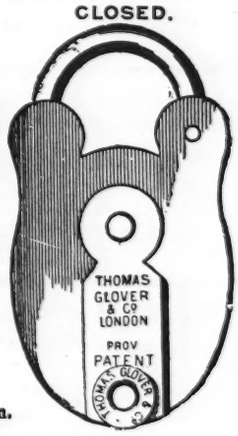

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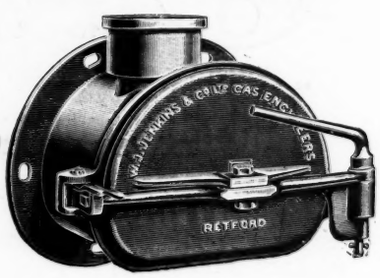

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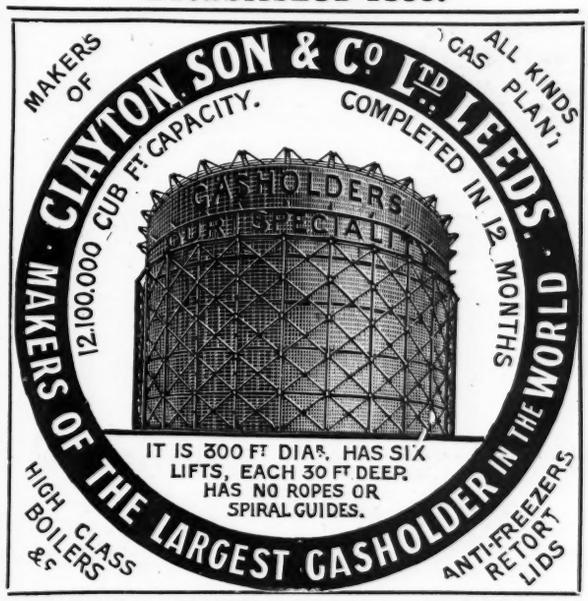
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[See also Advt. p. 1440.

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